



The Phantom of the Opera



DATA EAST PINBALL ®

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CPU JUMPER TABLE

Game	CPU* Version	ROM Location	Jumpers	
			Installed	Removed
Laser Wars	Ver 1	5C	J1b,J3,J4,J6a,J7a,&J8	J1a,J2,J5,J6,&J7b
	Ver 2	5C	J1b,J3,J4,J5a,J6a,J7b,&J8	J1a,J2,J5,J5b,J6b,&J7a
Secret Service	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
Torpedo Alley	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
Time Machine	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
Playboy	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
ABC M.N. Football	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
Robocop	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a
Phantom of the Opera	Ver 2	5B,5C	J1b,J3,J4,J5b,J6b,J7b,&J8	J1a,J2,J5,J5a,J6a,&J7a

*Version 1 has a 2K RAM which is a 24-pin IC at location 5D.

*Version 2 has an 8K RAM which is a 28-pin IC at location 5D.

Power-up CPU Self Tests

Upon power-up, the CPU board performs a series of self tests of major components. Turn the game on while observing the LEDS on the CPU board. Tests of the PIAs, RAM, and EPROMs are performed automatically and results of the test are indicated by the PIA LED.

With all tests passed, the LEDs illuminate in the following sequence at power turn-on. The PIA and +5V LEDs illuminate immediately. Approximately 1/2-second later the PIA LED goes out and the Blanking LED illuminates; the +5V and Blanking LEDs remain illuminated until the game is turned off. Test failures are indicated with the PIA LED:

PIA LED	SUSPECT COMPONENT
Stays On	One of the 6821 PIAs
Flashes 1 Time	6064 RAM at location D5.
Flashes 2 Times	EPROM at location B5.
Flashes 3 Times	EPROM at location C5.

QUICK REFERENCE FUSE CHART

PPB BOARD

F1 5A Slo-Blo G.I. 6.3VAC
 F2 5A Slo-Blo G.I. 6.3VAC
 F3 5A Slo-Blo G.I. 6.3VAC
 F4 5A Slo-Blo G.I. 6.3VAC
 F5 5A Slo-Blo Flipper Power 48VAC
 F6 3A Slo-Blo PPB Solenoids/Flash Lamps (34VDC)

POWER SUPPLY BOARD

F1 7A Slo-Blo +5VDC Regulator Input (9VAC)
 F2 7A Slo-Blo +5VDC Regulator Input (9VAC)
 F3 0.25A Slo-Blo Display Reg. Input (90VAC)
 F4 8A Slo-Blo Switched Illumination Buss (18VDC)
 F5 4A Slo-Blo Solenoid Buss (34VDC)
 F6 5A Slo-Blo Solenoid Buss (34VDC)

Five individual fuses for the Turbo Bumpers and Slingshots -2.5A Slo-Blo

Phantom of the Opera

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DATA EAST LIMITED WARRANTY

Data East USA, Inc., ("Seller") warrants only to the initial purchaser of its products that the items listed below are free from defects in material and workmanship under normal use and service for the warranty period specified:

PRINTED CIRCUIT BOARDS (GAME LOGIC) 60 DAYS

No other parts of Seller's product are warranted.

Warranty periods are effective from the initial date of shipment from Seller to its authorized distributors.

Seller's sole liability shall be, at its option, to repair or replace products which are returned to Seller during the warranty periods specified, provided:

1. Seller is notified promptly upon discovery by purchaser that stated products are defective.
2. Such products are properly packaged and then returned freight prepaid, to Seller's plant.

This warranty does not apply to any parts damaged during shipment and/or due to improper handling, or due to improper installation or usage, or alteration. In no event shall the Seller be liable for any anticipated profits, loss of profits, loss of use, accidental or consequential damages or any other losses incurred by the customer in connection with the purchase of a Data East USA., product.

WARRANTY DISCLAIMER

EXCEPT AS SPECIFICALLY PROVIDED IN A WRITTEN CONTRACT BETWEEN SELLER AND PURCHASER, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

WARNING--This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

GAME SPECIFICATIONS

POWER REQUIREMENTS

This game is provided with a 3-prong plug and **must be connected to a properly grounded outlet to reduce shock hazard** and insure proper game operation. Refer to AC Power Wiring Diagram for transformer connections required for normal, high, and low line conditions.

Normal Line: 109 to 129 Vac (211 to 225 Vac)

High Line: (226 to 235 Vac)

Low Line: 95 to 108 Vac (200 to 210 Vac)

MAJOR ASSEMBLY AND FUSE LOCATIONS

Refer to the Game Illustration (page 2) to identify locations of the major assemblies, and fuse values and locations.

PROM SUMMARY

CPU Board: Location 5B, 5C

Sound Board: Locations 6F (Voice ROM 1), 4F (Voice ROM 2), and 7F (Sound ROM)

TRANSPORTATION

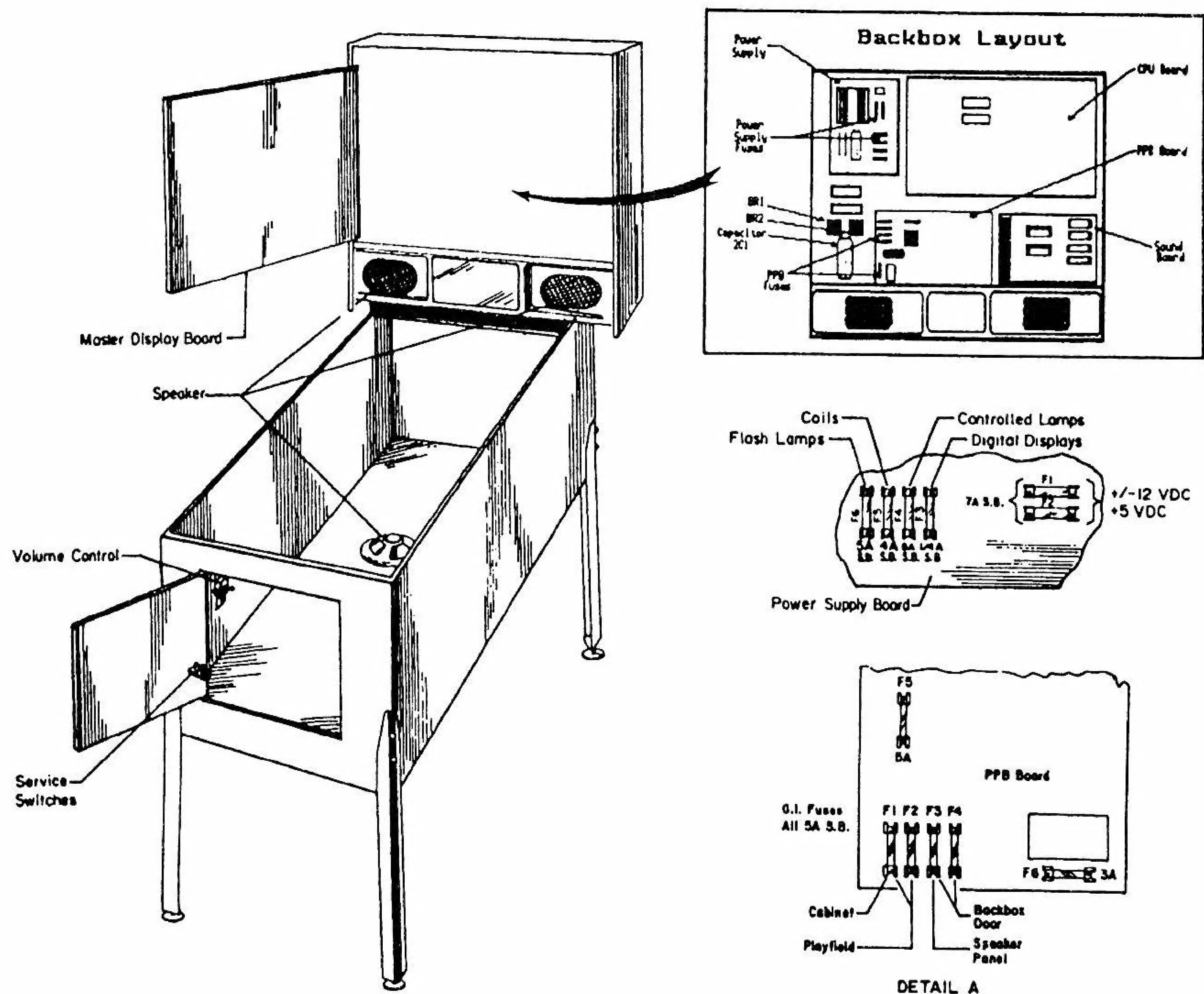
To reduce the possibility of damage, observe the following precautions whenever transporting the game. Lower the backbox and secure it to the cabinet. Remove the legs and secure the game within the transporting vehicle.

GAME ASSEMBLY PROCEDURES (Refer to the Game Illustration on page 2)

1. Open the top of the carton and lay it on its side with the bottom of the cabinet down. Using the plastic banding strip as a handle, slide the game out of the carton.
2. Remove all packing material. Locate cabinet legs in filler packing inserts and assembly parts package in the cashbox. There should be four leg levelers, eight leg bolts, two head bolts with washers, and three pinballs.
3. Attach leg leveler from the parts package to each leg, make sure that each leveler is threaded through a hex nut before threading it into the leg.
4. Support rear of cabinet and attach rear legs using two leg bolts for each leg.
5. Support front of cabinet and attach front legs using two leg bolts for each leg.
6. While assuring that no cables are being pinched, carefully raise the backbox and temporarily secure it in its upright position with the clamps provided on the rear of the cabinet.

WARNING

Do not attempt to move the game with the backbox secured in this temporary manner. If moved, the backbox could come unclamped and suddenly fall to the lowered position resulting in possible **injury to personnel and equipment damage**.



GAME ILLUSTRATION

7. Remove the backbox keys from the clip on the inside of the coin door and unlock and carefully remove the backglass. Set the backglass aside.
8. Carefully remove the playfield glass and set it aside.
9. Obtain the two bolts and washers from the parts package and open the backbox insert board. Secure the backbox to the cabinet pedestal with the two bolts and washers.
10. Check all connectors in the backbox for loose wire terminations. Reseat any loose wire by pushing in on the terminal.
11. Push on all connectors plugged into the CPU board, Sound Board, Power Supply Boards, and (on Insert board) Display board to check that they are properly seated.
12. Check that the fuses on the Power Supply board, PPB board and fuse panel are seated properly.
13. Raise the playfield and the support bar on the right side of the cabinet; support the playfield by inserting the support bar into the countersunk notch on the bottom side.
14. Check all cabinet cable and playfield lamp board connector terminations.

15. Remove the Plumb tilt from the parts package and install on the panel on the inside left of the cabinet. Note that this game is not equipped with a ball roll tilt.

16. Lower the playfield and level the playfield side-to-side by adjusting leg levelers.

17. The playfield front-to-back incline is factory set at approximately 6 degrees. If a pitch indicating meter is not available, adjust the front and rear levelers to the lowest position for the proper pitch. Readjust side-to-side level as required.

NOTE

The playfield incline affects difficulty of play. Use the recommended incline; game difficulty is best varied using game adjustments.

18. Check the plumb tilt and adjust as required.

19. If desired, perform any self tests at this time. With the insert door closed, carefully reinstall and lock the backglass.

20. Place the three pinballs on the playfield near the outhole and carefully reinstall the playfield glass.

21. If desired, make game pricing and Add-A-Ball, Novelty, or 5-Ball Play adjustments at this time.

GAME OPERATION

STANDARD FEATURES

Insert coin(s), the game makes a sound for the first credit and generates sounds for each subsequent coin and the Player 4 display indicates the number of credits posted. Depress the credit button and a start-up sound is produced, the posted credits are reduced by one, Player 1 display flashes, Player 4 display indicates BALL 1, and a ball is served to the plunger trough. Additional players may be added by depressing the Credit button before the end of ball 1.

The second closure (adjustable) of the plumb bob tilt switch tilts the ball in play. Closure of the slam tilt switch in the coin door ends the current game(s).

At the end of each ball, earned bonuses are collected. At the end of the last ball for the last player and after bonuses are collected, the system produces a random 2-digit number (a multiple of 10; 00 to 90) for a Match feature (adjustable). Matching the last two digits of a player score with this number awards a credit. Players exceeding high score levels receive free credits (adjustable) and are able to enter their initials with the new High Score achieved. The game then proceeds into the game-over mode and then to the attract mode. A custom message (adjustable) can be displayed during the attract mode.

AUTOMATIC BALL TIME AVERAGING

A ball time averager feature is provided which can make automatic adjustments affecting player appeal. This feature is provided by 'quick look' adjustment Ad 15 and is enabled as the factory setting. Periodically a check is made of the average ball time and adjustments are made to maintain approximately 65-second ball time. This check is made at the same time that highest scores are reset (expanded ADJUSTMENT E Ad 36) so make sure that E Ad 36 is not set to OFF. (Note that the other highest score adjustments may be disabled if desired.) Refer to Game Adjustments for additional details.

MANUAL PERCENTAGING

This game is equipped with Manual Percentage Adjustment.

As previously with our games, you can either set operator adjustments for a replay percent or you can set a fixed replay score.

If you set operator adjustments for a particular replay percent, the game will compute a recommended score to keep the game at that replay percentage. If a change is recommended and the game coin door is opened, the displays will indicate a recommended replay score to beat and make a sound to alert the operator. By pressing the start button, the score to beat will be changed to the recommended level. If you close the coin door or go into audit or adjustment mode, no score change will be made.

You may choose to ignore the recommended change; for example, you may not think last week's players were the usual crowd . Just close the door and the message will disappear without altering the existing level. Or you may choose to make a different score to beat adjustment; this is done by utilizing adjustment AD02.

GAME SPECIFIC FEATURES

Magic Mirror- Each shot through the Magic Mirror advances the bonus multiplier to 2x, 3 x, 4x, & 5x. After achieving 5x, the next shot through the Mirror lites the Extra ball, and the shot after that lites Bonus Hold.

Unlimited Millions-Each shot around the catwalk adds another letter to the word P-H-A-N-T-O-M. As soon as the last letter is completed, (M) the following consecutive shots to the ramp, award 1 million points per shot until the ramp is missed.

Grasshopper and Scorpion- Completing both the left and right target banks award either 100,000 points, 50,000 Points and Bonus Hold, Lites the Trapdoor Extra Ball or Lites the Catwalk Special depending which square is lit when the banks are completed. (The lit square is randomly selected.)

Trap Door - Every entry through the Trap Door awards one of the following Mystery Values shown on the display:

75,000 Points	200,000 Points	Instant 2 Ball	Extra Ball
100,000 Points	Double Jackpot	5,000 Box Lit	Phantom Lit

Double Score-On the games last ball, shooting the Catwalk Ramp twice in a row, results in multiplying the players existing score by 2.

Jackpot Buildup -Light the three Top Lanes to start the Jackpot Build Timer. Before the timer counts down, all playfield switches actuated add to the Jackpot: 1,000 points multiplied by the number times the Top 3 Lanes were lit.

Organ operation - The Organ will be opened to allow capturing balls by:

Completing all three Organ targets or
Completing the Shooter Lane Skill Shot through the single lit lane at the start of each new ball.

Once a ball is captured, closing any two playfield switches opens the Organ and releases the captured ball . Now the object is to lock one of the two balls in the organ, starting a countdown timer. Before the timer reaches zero, lock the second ball in the Organ to initiate 3 ball play. After the third ball is shot on to the playfield, the two captured balls are released. With all three balls on the playfield, any ball striking an Organ Target opens the Organ and starts the Jackpot Countdown. Before the timer reaches zero, shoot a ball into the organ to collect the Jackpot.

Refer to the Game Specific Adjustments on page 18 for additional information.

AUDIT FUNCTIONS

GENERAL

There are 74 audit functions provided for accounting purposes and for evaluation of game difficulty adjustments. Audit functions are split into two groups. There are eleven most-used audits (AU01 through AU11) in a 'quick look' group and 62 less-used audits (E AU13 through E AU74), in an 'expanded' group. The various auditing functions are summarized in the **AUDITING FEATURES TABLE** and, when accessed, are shown on the player score displays. The *Audit Number* is shown in the Player 3 Display, the *Description* in the Player 1 and 2 Displays, and the *Audit Total* in the Player 4 Display. Access and control is provided from switches located on the inside of the coin door.

To access audit functions, open the coin door and make sure that the FORWARD/REVERSE switch is in the FORWARD (up) position. Depress the STEP switch and the game name is shown in the Player 1 and 2 displays, the Player 3 display is blank, and the PROM revision level is shown in the Player 4 display. This indicates access to audit functions.

With the FORWARD/REVERSE push-button switch still in the FORWARD (up) position, depressing the STEP push-button switch advances through the audit functions one at a time. To review lower-numbered functions, set the forward/reverse push-button switch to the REVERSE (down) position and operate the STEP push-button switch.

To access expanded audits, operate the step push-button until AU12, EXPAND AUDITS is displayed. Set the choice to ON as indicated in the Player 4 display by depressing the Game Start push-button and then depress the step push-button. The request is installed and E AU13 is displayed. When you exit audits and adjustments, the AU12 setting is returned to off for the next time that a review of audits are required.

Audit totals may be reset to zero using Game Adjustment Ad17, Audits Reset. Game adjustments (Ad01 to Ad19 and E Ad20 to E Ad63) begin after the last audit function (AU12 or E AU74). Once audits functions have been recorded, and if no adjustments are required, you may return the game to the attract mode. If adjustments are required, continue pressing the STEP button until the game adjustments are reached. See Game Adjustments for details.

'QUICK LOOK' FUNCTIONS

Total Paid Credits (AU01) - the total number of paid credits is displayed.

Free Percent (AU02) is Free Total (E AU14) divided by Plays Total (E AU13).

Ball Time Average (in seconds) (AU03) is Total Play Time (in minutes) (E AU20) divided by Total Balls Played (E AU21) with the result multiplied by 60.

Coins (AU04, 05, and 06) - These three audit totals are provided to show the amount of coins registered for the left, right, and center coin chutes, respectively.

Replay Percentage (AU07) is the Replay Total awards for exceeding replay score levels (E AU15) divided by Plays Total (E AU13).

High Score Percentage (AU08) is High Score Total (E AU19) divided by Plays Total (E AU13).

Extra Ball Total (AU09) is the total number of extra balls awarded.

Extra Ball Percentage (AU10) is AU09 divided by Balls Total (E AU21).

Cycles Burn In (AU11) provides the number of diagnostic burn-in cycles (factory use).

Expand Audits (AU12) permits viewing of expanded audits.

Phantom of the Opera Audit Table

Audit Number (Player 3 Display)	Audit Description (Players 1 & 2 Displays: totals in Player 4 Display)	Audit Number (Player 3 Display)	Audit Description (Players 1 & 2 Displays: totals in Player 4 Display)
AU 01	Phantom PROM ID	E AU 38	Square 1 Lit
AU 02	Total Paid Credits	E AU 39	Square 2 Lit
AU 03	Percent Free	E AU 40	Square 3 Lit
AU 04	Ball Time Average	E AU 41	Square 4 Lit
AU 05	Coins Left	E AU 42	Square 1 Scored
AU 06	Coins Right	E AU 43	Square 2 Scored
AU 07	Coins Center	E AU 44	Square 3 Scored
AU 08	Replay Percent	E AU 45	Square 4 Scored
AU 09	High Score Percent	E AU 46	Left Return
AU 10	Extra Ball Total	E AU 47	Right Return
AU 11	Extra Ball Percent	E AU 48	Special Lit
AU 12	Cycles Burn-In	E AU 49	Drain Left
E AU 13	Expand Audits (ON/OFF)	E AU 50	Drain Center
E AU 14	Plays Total	E AU 51	Drain Right
E AU 15	Free Total	E AU 52	2x Bonus
E AU 16	Replay Total	E AU 53	3x Bonus
E AU 17	Special Total	E AU 54	4x Bonus
E AU 18	Special Percent	E AU 55	5x Bonus
E AU 19	Match Total	E AU 56	Mirror Ex Ball
E AU 20	Hi Score Wins	E AU 57	2X Scores
E AU 21	Playtime	E AU 58	Buy In Games
E AU 22	Balls Total	E AU 59	Average Game Time
E AU 23	1 Replay Awards	E AU 60	100K Scored
E AU 24	2 Replay Awards	E AU 61	Bonus Scored
E AU 25	3 Replay Awards	E AU 62	Audit
E AU 26	4 Replay Awards	E AU 63	Audit
E AU 27	Games 1Player	E AU 64	Audit
E AU 28	Games 2Player	E AU 65	Audit
E AU 29	Games 3Player	E AU 66	Audit
E AU 30	Games 4Player	E AU 67	Audit
E AU 31	Cycles Attract	E AU 68	Audit
E AU 32	Cycles H.S. Reset	E AU 69	Audit
E AU 33	Enter Level 3	E AU 70	Audit
E AU 34	Percent Level 3	E AU 71	Audit
E AU 35	Enter Level 2	E AU 72	Audit
E AU 36	Percent Level 2	E AU 73	Audit
E AU 37	Jackpot Ready	E AU 74	Audit
	Jackpot Scored		Tickets Credits

EXPANDED FUNCTIONS

Plays Total (E AU13) is the sum of Total Paid Credits (AU01) and Free Total (E AU14). Note that free credits are not recorded in the audits until they are actually used.

Free Total (E AU14) is the total free credits for replays, high-score-to-date, specials, and match.

Replay Total (E AU15) is the total awards (credits, extra balls, or audit only) for exceeding replay score levels.

Special Total (E AU16) is the total awards (credits, extra balls, or scores) for making specials.

Special Percentage (E AU17) is Special Total (E AU16) divided by Plays total (E AU13).

Match Total (E AU18) is the total credits awarded for matching the last two digits of the score with the system-generated Match Number at the end of the game. Percentage of match credits will be approximately 8%, if enabled.

High Score Wins (E AU19) is the total credits awarded for exceeding the high-score-to-date scores.

Play Time (E AU20) is the cumulative time of balls in play (in minutes).

Balls Total (E AU21) is the total of regular and extra balls.

Replay Awards (E AU22 through 25) provide the total awards (credit, extra ball, or audit) for replay levels 1 through 4, respectively.

Games - Player (E AU26 through 29) provide individual totals of 1- player, 2-player, 3-player, and 4-player games, respectively.

Cycles Attract (E AU30) provides the number of cycles through the attract mode (factory use).

Cycles High Score Reset (E AU31) provides the number of times that the high score levels have been automatically reset (if enabled).

GAME SPECIFIC FUNCTIONS

Enter Level 3 (E AU32) provides the number of times three ball multiball was accomplished.

Percent Level 3 (E AU33) provides the percentage of games that three ball multi-ball was accomplished.

Enter Level 2 (E AU34) provides the number of times two ball multiball was accomplished.

Percent Level 2 (E AU35) provides the percentage of games that two ball multi-ball was accomplished

Jackpot Ready (E AU36) provides the total number of times the Jackpot feature was enabled.

Jackpot Scored (E AU37) provides the total number of times .

Square 1 Lit (E AU38) provides the total number of times the "100,000 point" Square was lit.

Square 2 Lit (E AU39) provides the total number of times the "Bonus Hold + 50,000 point" Square was lit.

Square 3 Lit (E AU40) provides the total number of times "Extra Ball Square" was lit.

Square 4 Lit (E AU41) provides the total number of times the "Lite Special" Square was lit.

Square 1 Scored (E AU42) provides the total number of times Square 1 was collected by completing all Scorpion and Grasshopper targets.

Square 2 Scored (E AU43) provides the total number of times Square 2 was collected by completing all Scorpion and Grasshopper targets.

Square 3 Scored (E AU44) provides the total number of times Square 3 was collected by completing all Scorpion and Grasshopper targets.

Square 4 Scored (E AU45) provides the total number of times Square 4 was collected by completing all Scorpion and Grasshopper targets.

Left Return (E AU46) provides the total number of times the Left Return switch was closed .

Right Return (E AU47) provides the total number of times the Right Return switch was closed .

Special Lit (E AU48) provides the total number of times the Special Lite was Lit.

Drain Left (E AU49) provides the number of times the ball drained out the left drain.

Drain Center (E AU50) provides the number of times the ball drained out the center drain.

Drain Right (E AU51) provides the number of times the ball drained out the right drain.

2X Bonus (E AU52) provides the number of times 2x bonus was made.

3X Bonus (E AU53) provides the number of times 3x bonus was made.

4X Bonus (E AU54) provides the number of times 4x bonus was made.

5X Bonus (E AU55) provides the number of times 5x bonus was made.

Mirror Extra Ball (E AU56) provides the number of times the Mirror Extra Ball Feature was awarded.

2x Scores (E AU57) provides the number of times 2x Playfield Values feature was awarded.

Buy-In-Games(E AU58) provides the total number of times a game was bought into retaining lit game features.

Average Game Time (E AU59) provides the average length of a game in seconds.

100K Scored (E AU60) provides the total number of times the 100,000 point feature was awarded.

Bonus Scored (E AU61) provides the total number of times the Bonus Hold Feature was awarded.

Scoring History

Audit (E AU62) provides the total number of games the Player's final score was between 0 and 499,990 points.

Audit (E AU63) provides the total number of games the Player's final score was between 500,000 and 999,990 points.

Audit (E AU64) provides the total number of games the Player's final score was between 1,000,000 and 1,499,990 points.

Audit (E AU65) provides the total number of games the Player's final score was between 1,500,000 and 1,999,990 points.

Audit (E AU66) provides the total number of games the Player's final score was between 2,000,000 and 2,499,990 points.

Audit (E AU67) provides the total number of games the Player's final score was between 2,500,000 and 2,999,990 points.

Audit (E AU68) provides the total number of games the Player's final score was between 3,000,000 and 3,999,990 points.

Audit (E AU69) provides the total number of games the Player's final score was between 4,000,000 and 4,999,990 points.

Audit (E AU70) provides the total number of games the Player's final score was between 5,000,000 and 5,999,990 points.

Audit (E AU71) provides the total number of games the Player's final score was between 6,000,000 and 7,999,990 points.

Audit (E AU72) provides the total number of games the Player's final score was between 8,000,000 and 9,999,990 points.

Audit (E AU73) provides the total number of games the Player's final score was over 10,000,000 points.

Tickets Credits (E AU74) provides the total number off tickets awarded for exceeding the ticket level scores enabled. (See extended adjustments E Ad 58 through E Ad 62 page).

GAME ADJUSTMENTS

GENERAL

There are 63 adjustable functions provided to vary difficulty of play and to periodically reset audits and the high score levels. The various game adjustments are summarized in the **Game Adjustments Table** and, when accessed, are shown on the player score displays. The *Adjustment Number* is shown in the Player 3 Display, the *Description* in the Player 1 and 2 Displays, and the setting in the Player 4 Display. Access and control is provided from switches located on the inside of the coin door.

Game adjustments are accessed from the audit mode. With the audits displaying game identification and the FORWARD/REVERSE switch in the REVERSE (down) position, depress the STEP switch and E Ad63 (Expanded Adjustment 63) is shown in the Player 3 display, FACTORY RESET is shown in the Player 1 & 2 displays, and OFF is shown in the Player 4 display. With the audits displaying AU12 (or expanded E AU74) and the FORWARD/REVERSE switch in the FORWARD (up) position, depress the STEP switch and Ad01 is shown in the Player 3 display, REPLAY MANUAL/FIXED is shown in the Player 1 and 2 displays, and the setting is shown in the Player 4 display.

With the FORWARD/REVERSE switch in the FORWARD (up) position, depressing the STEP switch advances through the game adjustments one at a time. With it in the REVERSE (down) position, the STEP switch selects lower-numbered adjustments. To rapidly scroll through adjustments, hold the STEP switch depressed. Adjustment values are changed by operating the GAME START push-button. The FORWARD/REVERSE switch setting determines whether the values are increased or decreased. (With the FORWARD/REVERSE switch up, the value increases, with it down, the value decreases). When the STEP switch is depressed the Player 1 and 2 displays indicate REQUEST INSTALLED.

REPLAY AND GENERIC FEATURES

Replays may be adjusted either for fixed levels or for a system-adjusted manual percentage of replay awards. Four levels may be selected. Adjustments allow awarding of a credit or an extra ball as each level is exceeded. With the manual percentage feature, if the actual replay percentage is higher or lower than that desired, the game computes new recommended manual percentage score(s). When the coin door is subsequently opened the player displays indicate the recommended level and the Knocker knocks to alert the operator of a potential change. This new level is entered into adjustments simply by pressing the game start push-button. (If the coin door is closed or you enter audits/adjustments or diagnostics, the replay level is not changed.)

REPLAYS (Ad 01 through 06)

Ad 01 Replay Manual/Fixed

Manual: Adjust for percentage of awards for replay levels (1% through 50%). Proceed to Ad 02 and 03 for starting replay levels.

Fixed: Lower the automatic value below 1% and Player 1 display indicates FIXED. Proceed to Ad 02 through 05 for fixed replay levels.

Ad 02 Start Replay/Level 1 Replay

Manual: With Ad 01 set for manual, adjust the starting Replay 1 setting to between 800,000 and 9,900,000.

Fixed: With Ad 01 set for fixed, adjust Replay 1 level to between 100,000 and 9,900,000. To disable Replay 1, lower the setting to 00.

Ad 03 Levels Replay/Level 2 Replay

Manual: With Ad 01 set for manual, adjust the number of replay levels to be active (1 to 4). Any additional starting replay levels are automatically set to values higher than Replay 1. Proceed to Ad 06.

Fixed: With Ad 01 set for fixed, adjust Replay 2 level to between 100,000 and 9,900,000. To disable Replay 2, lower the setting to 00.

Game Adjustment Table

Adjustment Number (Player 3)	Description (Players 1 & 2)	Factory Setting (Player 4)
AD 01	Replay/Manual	10%
AD 02	Start Replay/Level 1 Replay	2,900,000
AD 03	Levels Replay/Level 2 Replay	01
AD 04	Level 3 Replay	-
AD 05	Level 4 Replay	-
AD 06	Extra Easy Rules	OFF
AD 07	Easy Rules	OFF
AD 08	Factory Rules	ON
AD 09	Hard Rules	OFF
AD 10	Extra Hard Rules	OFF
AD 11	Novelty Rules	OFF
AD 12	5 Ball Rules	OFF
AD 13	Addaball Rules	OFF
AD 14	Standard/Custom Pricing	USA 1
AD 15	Time Setting	-
AD 16	Coin Reset	OFF
AD 17	Audits Reset	OFF
AD 18	Restore Hiscr	OFF
AD 19	Expand Adjustments	OFF
E Ad 20	Awards Replay	CREDITS
E Ad 21	Awards Special	CREDITS
E Ad 22	Match Feature	ON
E Ad 23	Balls/Game	03
E Ad 24	Warning Tilt	01
E Ad 25	Maximum Extra Balls	03
E Ad 26	Credits Limit	30
E Ad 27	Scores Highest	ON
E Ad 28	Credits High Score 1	03
E Ad 29	Credits High Score 2	00
E Ad 30	Credits High Score 3	00
E Ad 31	Credits High Score 4	00
E Ad 32	High Score 1 Backup	5,000,000
E Ad 33	High Score 2 Backup	4,000,000
E Ad 34	High Score 3 Backup	3,000,000
E Ad 35	High Score 4 Backup	2,500,000
E Ad 36	High Score Reset Every	700
E Ad 37	Free Play	OFF
E Ad 38	Left Coin Pulses	-
E Ad 39	Right Coin Pulses	-
E Ad 40	Center Coin Pulses	-
E Ad 41	Pulses For Credit	-
E Ad 42	Pulses For Bonus Credit	-
E Ad 43	Message Custom	ON
E Ad 44	Text	ENGLISH
E Ad 45	Attract Mode Music	ON
E Ad 46	Buy In Feature	OFF
E Ad 47	Bozo Ball	ON
E Ad 48	Flash Lamps	ON
E Ad 49	General Scores	FACTORY
E Ad 50	General Timer	FACTORY
E Ad 51	Organ Spots	OFF
E Ad 52	Laser Kick	ON
E Ad 53	Lane Spots Organ	ON
E Ad 54	Phantom Memory	BALL
E Ad 55	Lane Spot 5K	ON
E Ad 56	Mirror Extra Ball	ON
E Ad 57	Alert Operator	ON
E Ad 58	Ticket Dispenser	OFF
E Ad 59	Ticket Level 1	1,000,000
E Ad 60	Ticket Level 2	2,000,000
E Ad 61	Ticket Level 3	4,000,000
E Ad 62	Ticket Level 4	8,000,000
E Ad 63	Factory Restore	OFF

Ad 04 Level 3 Replay (Fixed Only) - With Ad 01 set for fixed, adjust Replay 3 level to between 100,000 and 9,900,000. To disable Replay 3, lower the setting to 00.

Ad 05 Level 4 Replay (Fixed Only) - With Ad 01 set for fixed, adjust Replay 4 level to between 100,000 and 9,900,000. To disable Replay 4, lower the setting to 00.

SINGLE-FUNCTION DIFFICULTY ADJUSTMENTS (Ad 06 to 10)

Any one of these five INSTALL adjustments may be activated to automatically select settings for multiple adjustments affecting game difficulty. After activation, the individual adjustments may be readjusted if desired. Refer to Install Adjustment Table for details.

Ad 06 Extra Easy Rules - Set to ON or OFF.

Ad 07 Easy Rules - Set to ON or OFF.

Ad 08 Factory Rules - Set to ON or OFF.

Ad 09 Hard Rules - Set to ON or OFF.

Ad 10 Extra Hard Rules - Set to ON or OFF.

NOVELTY / 5-BALL/ADD-A-BALL RULES (Ad 11, 12, 13)

One of these three INSTALL adjustments may be activated to automatically select settings for multiple adjustments. After activation, the individual adjustments may be readjusted if desired.

NOTE: When more than one of these features is required (for example, Add-A-Ball rules with 5-Ball Play) set only one of these rule features and then change additional adjustments. For the Add-A-Ball and 5-Ball Play example:

Ad 13 Add a Ball Rules = On
E Ad 23 Balls per Game = 5
E Ad 49 General Scores = Factory
E Ad 50 General Timer = Factory
E Ad 56 Mirror Extra Ball = On

By setting the game up in this fashion, all specials and replay levels will award an extra ball. However, because the operator desires 5-ball play, all game play features are set to 5 Ball settings.

Ad 11 Novelty Play Rules - Set to establish settings for no free play or extra balls; ON or OFF. If ON the following settings are established:

Ad 01 Manual Replay = Fixed
Ad 02 to Ad 05 Replays 1 to 4 = Off
E Ad 20 Awards Replay = Audit
E Ad 21 Awards Special = Score
E Ad 22 Match Feature = Off

E Ad 25 Maximum Extra Balls = 00
E Ad 27 Scores Highest = Off
E Ad 28 to 31 Credits High Score = 00
E Ad 56 Mirror Extra Ball = Off

Ad 12 5-Ball Play Rules - Set to establish recommended settings for 5-ball play; ON or OFF. If ON the following settings are established

Ad 01 Manual Replay = 07%
Ad 02 Replay Start = 6,000,000
Ad 03 Replay Levels = 01
E Ad 23 Balls Per Game = 05

E Ad 49 General Scores = Factory
E Ad 50 General Timer = Factory
E Ad 54 Phantom Memory = Ball
E Ad 56 Mirror Extra Ball = On

INSTALL ADJUSTMENT TABLE

Install Adjustment	Ad 06 Extra Easy	Ad 07 Easy	Ad 08 Factory	Ad 09 Hard	Ad 10 Extra Hard
E Ad 49 General Scores	EASY	EASY	FACTORY	HARD	HARD
E Ad 50 General Timer	EASY	FACTORY	FACTORY	FACTORY	HARD
E Ad 52 Laser Kick	ON	ON	ON	OFF	OFF
E Ad 54 Phantom Memory	BALL	BALL	BALL	PLAYER	RESET
E Ad 56 Mirror Extra Ball	ON	ON	ON	OFF	OFF

Ad 13 Add-A-Ball Rules - Set to disable awarding of credits, replacing replay and Special awards with an extra ball; **ON** or **OFF**. If **ON** the following settings are established:

E Ad 20 Awards Replay = Extra Ball
 E Ad 21 Awards Special = Extra Ball
 E Ad 22 Match Feature = OFF
 E Ad 27 Scores Highest = OFF
 E Ad 28 to 31 High Score Credits = 00

GAME PRICING (Ad 14 and E Ad 38 to 42)

There are two methods available for coin switch programming; Standard and Custom. Standard pricing uses a single adjustment (Ad 14) to select a pricing scheme shown in the **Standard Pricing Table**. Custom pricing is used to select additional pricing schemes defined by expanded adjustments E Ad 38 to 42. In order to program E Ad 38 to 42, Ad 14 must be set to **CUSTOM** and Ad 19 must be set to **ON** for expanded adjustments.

With Ad 14 set to **CUSTOM** and expanded adjustments selected, E Ad 38, 39, and 40 represent coin switch pulses for the left, right, and center coin slots. E Ad 41 prescribes the number of pulses required for one credit. For example, if E Ad 38 was set to 02 and E Ad 41 to 01 a coin in the left slot would produce two credits. Further, if E Ad 38 was set to 01 and E Ad 41 to 02, two coins in the left slot would be required for one credit.

E Ad 43 may be set to post bonus credits when a minimum amount of coins are inserted at one time. For example, if E Ad 38 was set to 01, E Ad 41 to 01 and E Ad 42 to 04, one credit would be posted for each of the first three coins in the left slot and two credits for the fourth coin.

Ad 14 Standard/Custom Pricing - Set for the desired pricing scheme from the Standard Pricing Table as indicated in the Player 1 and 2 displays. For Custom Pricing, set to **CUSTOM**. When set to **CUSTOM**, Expanded adjustments E Ad 38 to 42 are utilized to tailor each individual coin chute.

E Ad 38 Left Coin Switch Pulses - Set the number of pulses registered for closure of the left coin switch; 00 to 99.

E Ad 39 Right Coin Switch Pulses - Set the number of pulses registered for closure of the right coin switch; 00 to 99.

E Ad 40 Center Coin Switch Pulses - Set the number of pulses registered for closure of the center coin switch; 00 to 99.

E Ad 41 Coin Switch Pulses Required for 1 Credit - Set the number of coin switch pulses required to post one credit; 00 to 99.

E Ad 42 Coin Switch Pulses Required for Bonus Credit - Set the number of coin switch pulses required to award a bonus credit; 00 to 99.

STANDARD PRICING TABLE

Ad 14 Standard Pricing Select			Coin Mechs			Plays/Coins		
1	2	4	Left	Center	Right	Left	Center	Right
USA1	1COIN	1PLAY	25¢	\$1.00	25¢	1 PLAY/ 1COIN	4 PLAY/ 1COIN	1 PLAY/ 1COIN
USA2	4 COINS	3PLAYS	25¢	\$1.00	25¢	1 PLAY/ 2COIN 2 PLAY/ 3COIN 3 PLAY/ 4COIN	3 PLAY/ 1COIN	1 PLAY/ 2COIN 2 PLAY/ 3COIN 3 PLAY/ 4COIN
USA3	2 COINS	1 PLAY	25¢	\$1.00	25¢	1 PLAY/ 2COIN	2 PLAY/ 1COIN	1 PLAY/ 2COIN
USA4	2COINS	1 PLAY 1COIN BUY-1N	25¢		25¢	2 COINS FOR THE 1st PLAY 1PLAY/ 1 COIN ONLY DURING BUY-IN		
AUSTRIA COINAGE			5 SCH	10 SCH	10SCH	1 PLAY/ 2COIN 2 PLAY/ 3COIN 3 PLAY/ 4COIN	2 PLAY/ 1COIN 3 PLAY/ 2COIN	2 PLAY/ 1COIN 3 PLAY/ 2COIN
AUSTRALIA COINAGE			20¢		\$1.00	1 PLAY/ 2COIN		3 PLAY/ 1COIN
UK COINAGE			10P	50P	£1	1 PLAY/ 3COIN	2 PLAY/ 1COIN	5 PLAY/ 1COIN
SWISS 1 SWISS 2			1 SFR	2 SFR	5 SFR	Same as German 1 Same as German 2		
BELGIUM COINAGE			20f	50f	20f	1 PLAY/ 1COIN	3 PLAY/ 1COIN	1 PLAY/ 1COIN
GERMAN 5DM 1		7 PLAYS	1DM	2DM	5DM	1 PLAY/ 1COIN 7 PLAY/ 5COIN	2 PLAY/ 1COIN 8 PLAY/ 3COIN	7 PLAY/ 1COIN
GERMAN 5DM 2		9 PLAYS	1DM	2DM	5DM	1 PLAY/ 1COIN 3 PLAY/ 2COIN 5 PLAY/ 3COIN 7 PLAY/ 4COIN 9 PLAY/ 5COIN	3 PLAY/ 1COIN 7 PLAY/ 2COIN 10 PLAY/ 3COIN 14 PLAY/ 4COIN	9 PLAY/ 1COIN
NETHERLAND COINAGE			1 Guilder		1 Guilder	1 PLAY/ 2COIN		1 PLAY/ 2COIN
SWEDEN COINAGE			1KR	5KR	2KR	1 PLAY/ 3COIN 2 PLAY/ 5COIN	2 PLAY/ 1COIN	2 PLAY/ 1COIN
FRANCE COINAGE			1f	5f	10f	1 PLAY/ 3COIN 2 PLAY/ 5COIN	2 PLAY/ 1COIN	4 PLAY/ 1COIN
ITALY COINAGE			500L		500L	1 PLAY/ 1COIN		1 PLAY/ 1COIN
SPAIN COINAGE			25P		100P	1 PLAY/ 1COIN		5 PLAY/ 1COIN
JAPAN COINAGE					100¥			3 PLAY/ 2COIN

CUSTOM PRICING TABLE

Coin Mechs			Plays/Coins	Adjustment Numbers						
Left	Right	Center		14	19	38	39	40	41	42
25¢	25¢	\$1.00	1/25¢ 3/50¢ 1/25¢ 5/\$1.00 1/25¢/ 6/\$1.00	Custom Custom Custom	ON ON ON	01 01 05	01 01 05	04 04 20	01 01 04	02 04 20
5SCH	10SCH	10SCH	1/10 SCH 1/10 SCH 4/30SCH	Custom Custom	ON ON	01 04	02 08	02 08	02 06	00 00
20¢	\$1.00	--	1/20¢ 1/60¢ 2/\$1.00	Custom Custom	ON ON	01 01	05 05	00 00	01 03	00 05
10P	10P	50P	1/10P 6/50P 1/20P 3/50P	Custom Custom	ON ON	01 01	01 01	05 05	01 02	05 05

ADDITIONAL GENERIC FEATURES

Ad 15 Average Ball Time - Not Used in this game.

Ad 16 Coin Reset - When enabled (set to **ON**) all coin and paid credit totals will be reset to zero when STEP is depressed.

Ad 17 Audits Reset - When enabled (set to **ON**) all audit totals except for coins and paid credits will be reset to zero when STEP is depressed.

Ad 18 Restore High Score - When enabled (set to **ON**) the High Score Levels and associated initials will be restored to backup settings when STEP is depressed .

Ad 19 Expand Adjustments - When set to **OFF**, depressing the STEP push-button advances directly to E Ad 63, FACTORY RESET. When set to **ON**, depressing the STEP push-button sequences through the expanded adjustments. When exiting from expanded adjustments, this function is reset to **OFF** for the next time that adjustments are required.

E Ad 20 Awards Replay - Set for replays to award: **CREDIT**, **EXTRA BALL**, or **AUDIT** (no award but recorded in the audit totals).

E Ad 21 Awards Special - Set for Special to award: **CREDIT**, **EXTRA BALL**, or **SCORE LEVEL**.

E Ad 22 Match Feature- Set Match **ON** or **OFF**.

E Ad 23 Balls Per Game - Adjust the number of balls per game; 2 to 9.

E Ad 24 Warning Tilt - Adjust the number of plumb bob tilt switch closures before the ball in play is tilted; 1 to 3 or **OFF**.

E Ad 25 Maximum Extra Balls - Adjust for the maximum number of extra balls that may be accumulated per ball; 1 to 9 or **OFF**.

E Ad 26 Credits Limit - Adjust the maximum number of credits that may be posted; 5 to 99.

HIGH SCORE LEVELS (E Ad 27 through 36)

There are four high score levels with associated player initials that are displayed during the attract mode. This provides a high-score-to-date feature. When players exceed these levels, the player initials may be entered to replace the previous ones. These levels may be adjusted to award credits and to be reset to backup values after a selected number of games.

E Ad 27 Scores Highest - Set to enable or disable the four high score levels; ON or OFF.

E Ad 28 Credits High Score Level 1 - Adjust the number of credits awarded for exceeding level 1 (the highest of the four levels); 0 to 9.

E Ad 29 Credits High Score Level 2 - Adjust the number of credits awarded for exceeding level 2; 0 to 9.

E Ad 30 Credits High Score Level 3 - Adjust the number of credits awarded for exceeding level 3; 0 to 9.

E Ad 31 Credits High Score Level 4 - Adjust the number of credits awarded for exceeding level 4; 0 to 9.

E Ad 32 High Score 1 Backup - Adjust the backup score level to which level 1 (the highest of the four levels) may be reset.

E Ad 33 High Score 2 Backup - Adjust the backup score level to which level 2 may be reset.

E Ad 34 High Score 3 Backup - Adjust the backup score level to which level 3 may be reset.

E Ad 35 High Score 4 Backup - Adjust the backup score level to which level 4 may be reset.

E Ad 36 High Score Reset Every - Adjust the number of games between automatic resets of high score levels to backup settings and ball time averager adjustments; 100 to 900 or OFF (no reset or adjustment).

E Ad 37 Free Play - When set to ON, no coins are required for games.

E Ad 38 to 42 Custom Pricing - Described previously in Game Pricing.

E Ad 43 Message Custom - When desired, this function is used to establish a custom message periodically displayed during the attract mode. Set the feature to **CHANGE** using the Credit button and depress STEP. The letter **A** is indicated in the first position of the Player 1 display. Vary the letter by operating the left and right flippers. With the desired letter indicated, depress the CREDIT button to lock in the letter and advance to the next display character. Repeat this procedure until the desired message is indicated in the Player 1 and 2 displays. At this time, depress the STEP push-button switch to advance to E Ad 44.

NOTE

To lock in the custom message, the game must be returned to Game Over by depressing STEP with E Ad 63 displayed.

E Ad 44 English/German Text - Select English, or German for display during Audits, Adjustments, and Game Diagnostics.

E Ad 45 Attract Mode Music - Set to ON (once every seven attract mode cycles), or OFF.

E Ad 57 Alert Operator-When the game is first powered up and after it has passed it's self test, any suspect switches or coils are displayed in the Player Displays. With this feature enabled (set to ON), a sound is generated to alert the location attendant if there are any suspect switches or coils. With this feature disabled (set to OFF), no sound is generated during indications of suspect switches or coils.

E Ad 63 Factory Restore-Depressing STEP without changing the value shown in the Player 4 Display locks in any custom message set with E Ad43 and returns the game to GameOver.Set the value to ON and depress STEP switch to revert all game adjustments to factory settings, clear the Custom Message and return to Game Over.

GAME SPECIFIC FEATURES (E Ad 46 TO 62)

E Ad 46 Buy In Feature- Set to **ON** or **OFF**. When set to **ON** the PHANTOM feature, (when set to **BALL** in E Ad 54) will be retained if a player immediately buys into a game. When set to **OFF**, no features will be carried over to the next game.

E Ad 47 Bozo Ball- Set To **ON** or **OFF**. When **ON** the game will lite an Extra Ball outlane on the last ball for any player not acheiving 500,000 points by his last ball.

E Ad 48 Flash Lamps- Set to **ON** or **OFF**. When set to **ON** the Flash Lamps are active, when **OFF** the Flash Lamps do not flash.

E Ad 49 General scores- Set to **EASY,FACTORY** or **HARD**.

Feature Affected	Easy	Factory	Hard
Spinner	1000	500	100

E Ad 50 General Timer- Set to **EASY,FACTORY** or **HARD**.

Feature Affected	Easy	Factory	Hard
Jackpot Countdown	8 seconds	6 seconds	6 seconds
2 To 3 Ball Countdown	10 seconds	8 seconds	6 seconds

EAd 51 Organ Spots -Set to **ON** or **OFF**. When **ON** , closing any Organ Target switch will spot the next unlit lite on the organ. When **OFF**, closing an Organ Target switch will only spot the lite associated with it.

E Ad 52 Laser Kick- Set to **ON** or **OFF**. When **ON**, the Laser Kick feature is turned on at the start of each ball. When **OFF**, the feature is enabled for the second and subsequent balls only by making the Lite Laser Kick Trap Door shot when lit.

E Ad 53 Lane Spots Organ- Set to **ON** or **OFF**. When **ON**, making the Skill Shot at the start of each ball through the single lit top lane, opens the organ.

E Ad 54 Phantom Memory- Set to **BALL, PLAY** or **RESET**. When set to **BALL**, the leters lit in the word PHANTOM, carry over from ball to ball and from one player to the next. When set to **PLAY**, each player starts the game with no letters lit and builds up the value for PHANTOM from ball to ball. When set to **RESET** none of letters in PHANTOM are carried over to the next ball or Player.

E Ad 55 Lane Spot 5K-Set to **ON**, or **OFF**. When set to **ON**, completing all 3 top lanes lites the 5K Spinner Spot.

E Ad 56 Mirror Extra Ball-Set to **ON** or **OFF**.When set to **ON**, completing the Magic Mirror 6 times lights one of the outlanes that award an Extra Ball.

E AD 58 Ticket Dispenser- Set to **OFF** , **1, 2, 3** or **4**. When **OFF** the ticket dispenser is disabled. The settings **1, 2, 3, & 4** determine the number of award levels a ticket will be dispensed.

E Ad 59- Ticket Level 1 - Adjust the score level from 100,000 to 9,900,000 to award a ticket for exceeding the operator selected point value. This feature is enabled by E AD58

E Ad 60- Ticket Level 2 - Adjust the score level from 100,000 to 9,900,000 to award a ticket for exceeding the operator selected point value. This feature is enabled by E AD58

E Ad 61- Ticket Level 3 - Adjust the score level from 100,000 to 9,900,000 to award a ticket for exceeding the operator selected point value. This feature is enabled by E AD58

E Ad 62- Ticket Level 4 - Adjust the score level from 100,000 to 9,900,000 to award a ticket for exceeding the operator selected point value. This feature is enabled by E AD58

GAME DIAGNOSTICS

The Data East Pinball system provides tests for sounds, digital displays, lamps, switches, and solenoids. Each feature may be tested manually or automatically using the STEP and FORWARD/REVERSE push-button switches inside the coin door and the Game Start push-button switch on the front of the cabinet. The automatic tests may be used for a quick verification of automatic test functions and the manual tests, for troubleshooting.

During game play, activation of switches and operation of coils with associated switches are monitored. If a switch is not made for 100 games it is considered bad. When operation of a coil should close or open a switch and does not, the coil is considered bad. Each time the game is powered up, bad switches and coils (if any) are reported; to alert the location attendant, the credit knocker is pulsed. Note that reporting of an unused switch does not constitute a problem and that a bad coil could mean that the associated switch requires adjustment.

Wiring to switches, solenoids and controlled lamps uses color-coded wires that basically follows a resistor color-code scheme for the eight rows and eight columns. During the switch tests and during the discrete lamp test, identification of the color of the row and column wires are indicated in the Player 3 Display. For example, making the right coin switch during the Switch Test results in the switch functional name (RIGHT COIN) shown in the Player 1 and 2 Displays, the row (94) and column (51) wire color codes shown in the Player 3 display, and the switch number shown in the Player 4 display. The 94 code (refer to the chart below) indicates a White wire with Yellow stripe for the row wire and the 51 code indicates a Green wire with Brown stripe.

0 = Black	5 = Green
1 = Brown	6 = Blue
2 = Red	7 = Violet
3 = Orange	8 = Grey
4 = Yellow	9 = White

ENTERING DIAGNOSTICS

With the game in the game-over mode, open the coin door and make sure that the FORWARD/REVERSE push-button switch is set to REVERSE (down) and depress the STEP push-button switch. The Player displays will show the tollfree Customer Service number 1-800-KICKERS, that is 1-800-542-5377 (outside Illinois) and the toll number (708) 345-7700 (inside Illinois). this indicates entry into game diagnostics.

SOUND TESTS

The Data East Pinball sound system produces true digital stereo sound on left and right speakers and mono on a center speaker. During Sound tests, the Player 1 and 2 displays show the sound board circuit under test and the corresponding sounds are produced. Refer to the Sound Test Chart for the sound circuits displayed and the sounds produced.

The sine wave functions allow verification that all channels are functioning properly and that the speaker connections are correct. Speaker Phase Testing procedures follow for checking speaker connections.

SOUND TEST CHART

Auto/Manual Tests (Player 1 & 2)	Sounds Produced
LEFT SINE CENTER SINE RIGHT SINE VOICE ROM1 (Loc F6) VOICE ROM2 (Loc F4) MUSIC TEST (Sound ROM Loc F7)	60 CYCLE TONE (Left Speaker Only) 60 CYCLE TONE (All speakers) 60 CYCLE TONE (Right Speaker Only) "I am the Phantom of the Opera", Screech, Laugh, Breaking Glass, "One Million" "Nooo.....", "Magic Mirror", "Curtain Call", Thunder, "Ah...." MUSIC

Automatic Test

With Customer Service telephone numbers displayed, depress the STEP push-button switch. Player 1 and 2 displays indicate SOUNDS AUTO and the system sequences through the test producing the sounds indicated in the Sound Test Chart.

Manual Test

Operate the STEP push-button switch during the Automatic tests until SOUNDS MANUAL is indicated in the Player 1 and 2 displays. Depressing the Game Start push-button switch allows you to advance through each sound function.

Speaker Phase Testing

Connections to each of the three speakers are polarized and each must be connected appropriately for the best quality sound. If one speaker has the positive and negative connections reversed with respect to the other two, bass frequencies will not be produced properly and the overall sound quality will be poor.

To test for proper speaker phasing,, use the manual sound test to cycle through the Left, Center, and Right Sine functions. If the Center Sine produces more volume and bass than the Left and Right Sines, the speakers are connected properly. If it produces the same or less, one speaker is connected improperly. To isolate and correct reversed speaker connections, one of two methods may be used.

1. Check each speaker for polarity markings. If the speakers have polarity markings, verify that the single-color wire (BLK, YEL or RED) is connected to the negative (-) terminal.
2. Disconnect the speaker output connector from the Sound Board and connect a 1.5-volt battery across each speaker pair one at a time while observing the speakers. Make sure that the positive battery terminal is connected to the positive lead (CN1-pin 1, 3, or 6) each time. As the connection is made, check speaker cone movement; proper connections are indicated by outward movement.

DIGITAL DISPLAY TEST

Digital displays are driven by digit and segment driver circuits. Digit drivers sequentially select individual character positions for both displays (Player 1 and 2 display) and (Player 3 and 4 display). Segment drivers (16 for Player 1 and 2 characters; 16 for Player 3 and 4 characters) select the individual segments of each position.

Automatic Test

To enter Display tests, operate the STEP push-button switch from the Sound Manual test. Player 1 and 2 displays indicate DISPLAY AUTO. The displays will sequence from all ZEROS to all nines in the four displays. Next all segments are lit for each digit position in sequence.

Manual Test

Operate the TEST push-button switch from the automatic test; Player 1 and 2 displays indicate DISPLAY MANUAL and then display ZEROS in all positions. Operate the Game Start push-button switch to cycle through each portion of the test.

ORGAN TEST

This Game has a feature which raises a ramp (organ) to allow a shot to the cavern below the playfield. The motor on this mechanism is controlled by a relay driven by Q25 and there are 2 Limit switches (Organ Closed & Organ Open) used by the CPU to determine the status of the ramp.

After entering OrganTest, press and hold the game's Start Button. This will cause the motor relay to pulse repeatedly as long as the button is depressed. At the same time you will notice that the switch status will be shown in the Player 3 & 4 Displays - CLOSED in the Left display and OPEN in the Right display. The appropriate switch should be closed just prior to the limit of the organ mechanism and both switches should not be closed at the same time.

This test is located before the Switch tests so the technician can raise the mechanism half way until both CLOSED & OPEN switch contacts are electrically open. This will help eliminate erroneous readings while trying to trace a problem during Active Switch Test.

Switches

Switches are configured in an 8 x 8 matrix of columns (switch drives) and rows (switch returns) with up to 64 switches possible. The switch tests include three parts; switch test, active switches, and bad switches. Row and column wire colors are indicated in each test using corresponding resistor color code numbers.

Switch Test

From the Display Manual test, operate STEP push-button switch. Player 1 and 2 displays indicate SWITCH TEST. Close each switch and observe the displays. The Player 1 and 2 displays will indicate the switch name, the Player 3 display indicates the row and column wire colors, and the Player 4 display indicates the switch number. When a switch is released, the name and number disappear until another switch is closed or the test is exited.

Active Switches

Operate the STEP push-button switch from the Switch Test. Player 1 and 2 Displays indicate ACTIVE SWITCHES. If any switches are stuck closed (or made from the presence of a ball), the Player 1 and 2 displays sequence through switch names, the Player 3 display indicates the row and column wire colors, and the switch numbers are indicated in the Player 4 display. This cycle continues until all switches are cleared or until the STEP push-button switch is depressed.

Bad Switches

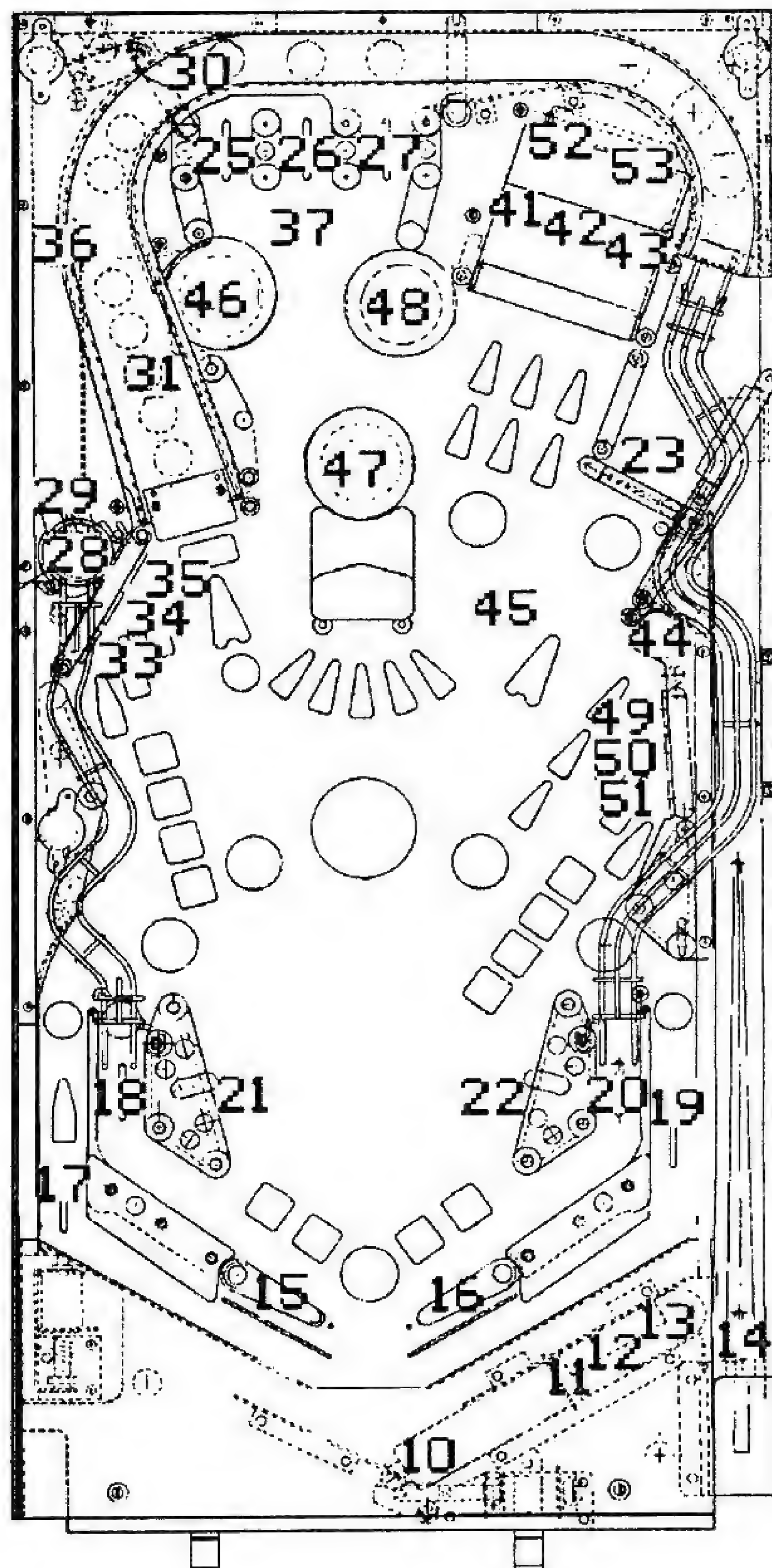
Operate the STEP push-button switch from the Switch Test. Player 1 and 2 Displays indicate BAD SWITCHES. During game play, the system keeps track of the last game in which each switch was made. Should a switch not be made for 100 games, it is considered to be bad. If there are any, the Player 1 and 2 displays sequence through switch names, the Player 3 display indicates the row and column wire colors, and the switch numbers are indicated in the Player 4 display. This cycle continues until the STEP push-button switch is depressed.

SWITCH MATRIX CHART

COLUMN ROW (*)	1 GRN-BRN (51) Q55	2 GRN-RED (52) Q54	3 GRN-ORN (53) Q53	4 GRN-YEL (54) Q52	5 GRN-BLK (50) Q51	6 GRN-BLU (56) Q50	7 GRN-VIO (57) Q49	8 GRN-GRY (58) Q48
1 WHT-BRN (91)	Plumb Tilt 1	Not Used 9	Left Outlane 17	Left Top Lane 25	Left Target 1 33	Center Target 1 41	Right Target 1 49	Not Used 57
2 WHT-RED (92)	Not Used 2	Outhole 10	Left Return 18	Center Top Lane 26	Left Target 2 34	Center Target 2 42	Right Target 2 50	Not Used 58
3 WHT-ORN (93)	Credit Button 3	Trough #1 11	Right Outlane 19	Right Top Lane 27	Left Target 3 35	Center Target 3 43	Right Target 3 51	Not Used 59
4 WHT-YEL (94)	Right Coin 4	Trough #2 12	Right Return 20	Left VUK #1 28	Top Super VUK 36	Right Super VUK 44	Organ Open 52	Not Used 60
5 WHT-GRN (95)	Center Coin 5	Trough #3 13	Left Slingshot 21	Left VUK #2 29	Organ Cave 37	Mirror Ramp 45	Organ Closed 53	Not Used 61
6 WHT-BLU (96)	Left Coin 6	Shooter Lane 14	Right Slingshot 22	Left Ramp Top 30	Not Used 38	Left Turbo Bumper 46	Not Used 54	Not Used 62
7 WHT-VIO (97)	Slam Tilt 7	Left EOS 15	Right Spinner 23	Left Ramp Bottom 31	Not Used 39	Center Turbo Bumper 47	Not Used 55	Not Used 63
8 WHT-GRY (98)	Not Used 8	Right EOS 16	Not Used 24	Not Used 32	Not Used 40	Right Turbo Bumper 48	Not Used 56	Not Used 64

(*) 2 DIGIT NUMBER IN PARENTHESES INDICATES RESISTOR/WIRE COLOR CODE NUMBER DISPLAYED DURING DIAGNOSTICS.

Number	Description	Part No.
01*	Plumb Tilt	500-5023-00
02	Not Used	--
03	Credit Button	500-5097-00
04*	Right Coin	180-5024-00
05*	Center Coin	180-5024-00
06*	Left Coin	180-5024-00
07*	Slam Tilt	180-5022-00
08	Not Used	--
09	Not Used	--



Switch Locations

Number	Description	Part No.
10	Out Hole	180-5011-00
11	Trough #1	180-5009-00
12	Trough #2	180-5009-00
13	Trough #3	180-5010-00
14	Shooter Lane	500-5142-00
15	Left Flip. Instant Info.	See Solid State
	Left EOS	Flipper Board
16	Right Flip. Instant Info.	See Solid State
	Right EOS	Flipper Board
17	Left Outlane	500-5142-00
18	Left Return Lane	500-5142-00
19	Right Outlane	515-5133-00
20	Right Return Lane	515-5133-00
21	Left Slingshot Trigger Sw.	180-5054-00
	Left Slingshot Point Sw.	180-5055-00
22	Right Slingshot Trigger Sw.	180-5054-00
	Right Slingshot Point Sw.	180-5055-00
23	Right Spinner	500-5193-01
24	Not Used	-
25	Left Top Lane	500-5142-00
26	Center Top Lane	500-5142-00
27	Right Top Lane	500-5142-00
28	Left VUK #1	180-5009-00
29	Left VUK #2	180-5051-00
30	Left Ramp Top	180-5034-00
31	Left Ramp Bottom	180-5010-00
32	Not Used	--
33	Left Target 1 (Bottom)	180-5058-00
34	Left Target 2 (Center)	180-5058-00
35	Left Target 3 (Top)	180-5058-00
36	Top Super VUK	180-5041-00
37	Organ Cave	180-5002-01
38	Not Used	--
39	Not Used	--
40	Not Used	--
41	Organ Target 1 (Left)	180-5058-00
42	Organ 2 Target (Center)	180-5058-00
43	Organ 3 Target (Right)	180-5058-00
44	Right Super VUK	180-5041-00
45	Mirror Ramp	180-5034-00
46	Left Pop Bumper	180-5036-00
47	Center Pop Bumper	180-5036-00
48	Right Pop Bumper	180-5036-00
49	Right Target 1 (Top)	180-5058-00
50	Right 2 Target (Center)	180-5058-00
51	Right 3 Target (Bottom)	180-5058-00
52	Organ Open	180-5052-00
53	Organ Closed	180-5052-00
54	Not Used Through 64	

*INDICATES CABINET SWITCHES.

LAMP TESTS

Controlled lamps are configured in an 8 x 8 matrix of columns (lamp drives) and rows (lamp returns) with up to 64 lamps possible. The lamp tests include four parts, all lamps, lamp return (row), lamp drive (column), and discrete (individual) lamps. Row and column wire colors are indicated in the discrete lamp test using corresponding resistor color code numbers.

All Lamps

From the Bad Switch test, operate the STEP push-button switch. Player 1 and 2 displays indicate ALL LAMPS and all controlled lamps will light.

Lamp Returns

From the ALL LAMPS test, depress the STEP push-button switch. Player 1 and 2 displays indicate LAMP ROWS and the Player 4 display indicates 01 for row 1. All controlled lamps in row 1 should be lit. Operating the Game Start push-button switch cycles through each of the rows separately.

Lamp Drives

From the LAMP ROWS test, depress the STEP push-button switch. Player 1 and 2 displays indicate LAMP COLUMNS and the Player 4 display indicates 01 for column 1. All controlled lamps in column 1 should be lit. Operating the Game Start push-button switch, cycles through each of the columns separately.

Discrete Lamp

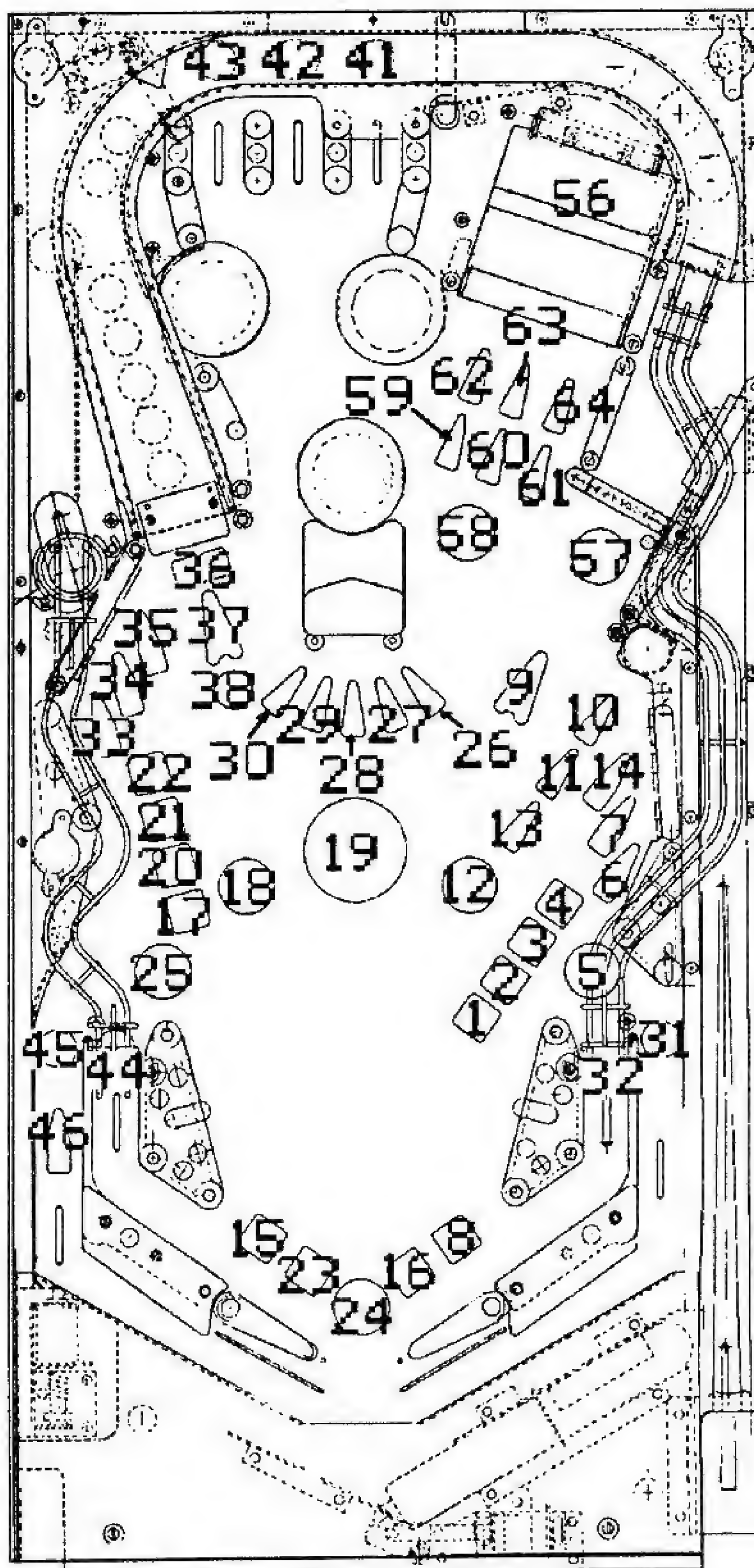
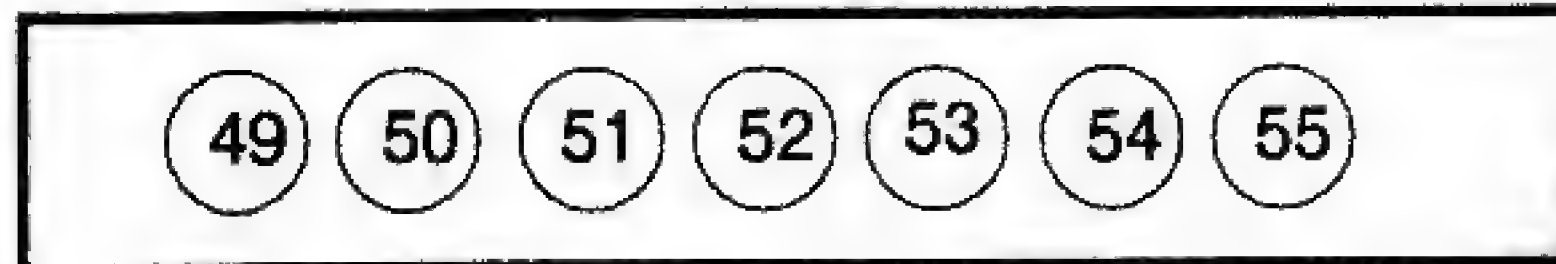
From the LAMP COLUMNS test, depress the STEP push-button switch. Player 1 and 2 displays indicate LAMP TEST and then the name assigned to lamp 01; the Player 1 and 2 displays indicate the lamp name, the Player 3 display indicates the row and column wire colors, and the Player 4 display indicates 01. Lamp 01 should light. With the FORWARD/REVERSE push-button switch in the FORWARD (up) position, operating the Game Start push-button switch selects higher-numbered lamps; with it in the REVERSE (down) position, Game Start selects lower-numbered lamps.

LAMP MATRIX CHART

COLUMN (*) ROW (*)	1 YEL-BRN (41) Q71	2 YEL-RED (42) Q70	3 YEL-ORN (43) Q69	4 YEL-BLK (40) Q68	5 YEL-GRN (45) Q67	6 YEL-BLU (46) Q66	7 YEL-VIO (47) Q65	8 YEL-GRY (48) Q64
1 RED-BRN (21) Q72	Right Square 4 1	Right Mystery 9	Left Square 4 17	Right Circle 25	Grass-hopper 1 33	Top Lane 3 41	Phantom Lamp 49	Box Lamp 57
2 RED-BLK (20) Q73	Right Square 3 2	Lock Arrow 10	Left Candle 18	5x Lamp 26	Grass-hopper 2 34	Top Lane 2 42	Phantom Lamp 50	Million Lamp 58
3 RED-ORN (23) Q74	Right Square 2 3	Lite Laser Kick 11	Phantom Lamp 19	4x Lamp 27	Grass-hopper 3 35	Top Lane 1 43	Phantom Lamp 51	Two Arrow 59
4 RED-YEL (24) Q75	Right Square 1 4	Right Candle 12	Left Square 3 20	Bonus Hold Arrow 28	2X Lit Lamp 36	Left Return 44	Phantom Lamp 52	Two Arrow 60
5 RED-GRN (25) Q76	Right Circle 5	Extra Ball Arrow 13	Left Square 2 21	3x Lamp 29	Left Mystery 37	Left Extra Ball 45	Phantom Lamp 53	Two Arrow 61
6 RED-BLU (26) Q77	Scorpion 3 6	Scorpion 1 14	Left Square 1 22	2x Lamp 30	Special Lamp 38	Laser Kick Lamp 46	Phantom Lamp 54	One Arrow 62
7 RED-VIO (27) Q78	Scorpion 2 7	100K Square 15	Bonus Hold Square 23	Right Extra Ball 31	Back-Glass 1 39	Back-Glass 3 47	Phantom Lamp 55	One Arrow 63
8 RED-GRY (28) Q79	Lite Special 8	Lite Extra Ball 16	Shoot Again 24	Right Return 32	Back-Glass 2 40	Back-Glass 4 48	Unused 56	One Arrow 64

(*) 2 DIGIT NUMBER IN PARENTHESES INDICATES RESISTOR/WIRE COLOR CODE DISPLAYED DURING DIAGNOSTICS.

Lamp Number	Description
01	Right Square 4
02	Right Square 3
03	Right Square 2
04	Right Square 1
05	Right Circle
06	Scorpion 3 (Bottom)
07	Scorpion 2 (Middle)
08	Lite Special
09	Right Mystery
10	Lock Arrow



□ Lamp Locations □

11	Lite Laser Kick
12	Right Candle
13	Extra Ball Arrow
14	Scorpion 1 (Top)
15	100 K Square
16	Lite Extra Ball
17	Left Square 4
18	Left Candle
19	Phantom Lamp
20	Left Square 3
21	Left Square 2
22	Left Square 1
23	Bonus Hold Square
24	Shoot Again
25	Left Circle
26	5X Lamp
27	4X Lamp
28	Bonus Hold Arrow
29	3X Lamp
30	2X Lamp
31	Right Extra Ball
32	Right Return
33	Grasshopper 1 (Bottom)
34	Grasshopper 2
35	Grasshopper 3 (Top)
36	2X Lit Lamp
37	Left Mystery
38	Special Lamp
39*	Backglass 1
40*	Backglass 2
41	Top Lane 3 (Right)
42	Top Lane 2
43	Top Lane 1 (Left)
44	Left Return
45	Left Extra Ball
46	Laser Kick Lamp
47*	Backglass 3
48*	Backglass 4
49	Phantom Lamp
50	pHantom Lamp
51	phAntom Lamp
52	phaNtom Lamp
53	phanTom Lamp
54	phantOm Lamp
55	phantoM Lamp
56	Unused
57	Box Lamp
58	Million Lamp
59	Two Arrow
60	tWo Arrow
61	twO Arrow
62	One Arrow
63	oNe Arrow
64	onE Arrow

*Indicates Insert Lamp

COIL TESTS

Sixteen regular (pulsed under microprocessor control) and six switch-triggered coil drivers are provided to switch ground to coils. Coil number 10 is used in conjunction with drives 1 through 8 to switch +32 volts between coils or flash lamps; these sets are termed "left" and "right". Coil number 10 is located on the PPB board which provides isolation diodes and current limiting resistors. This effectively provides 23 regular coils.

Automatic Test

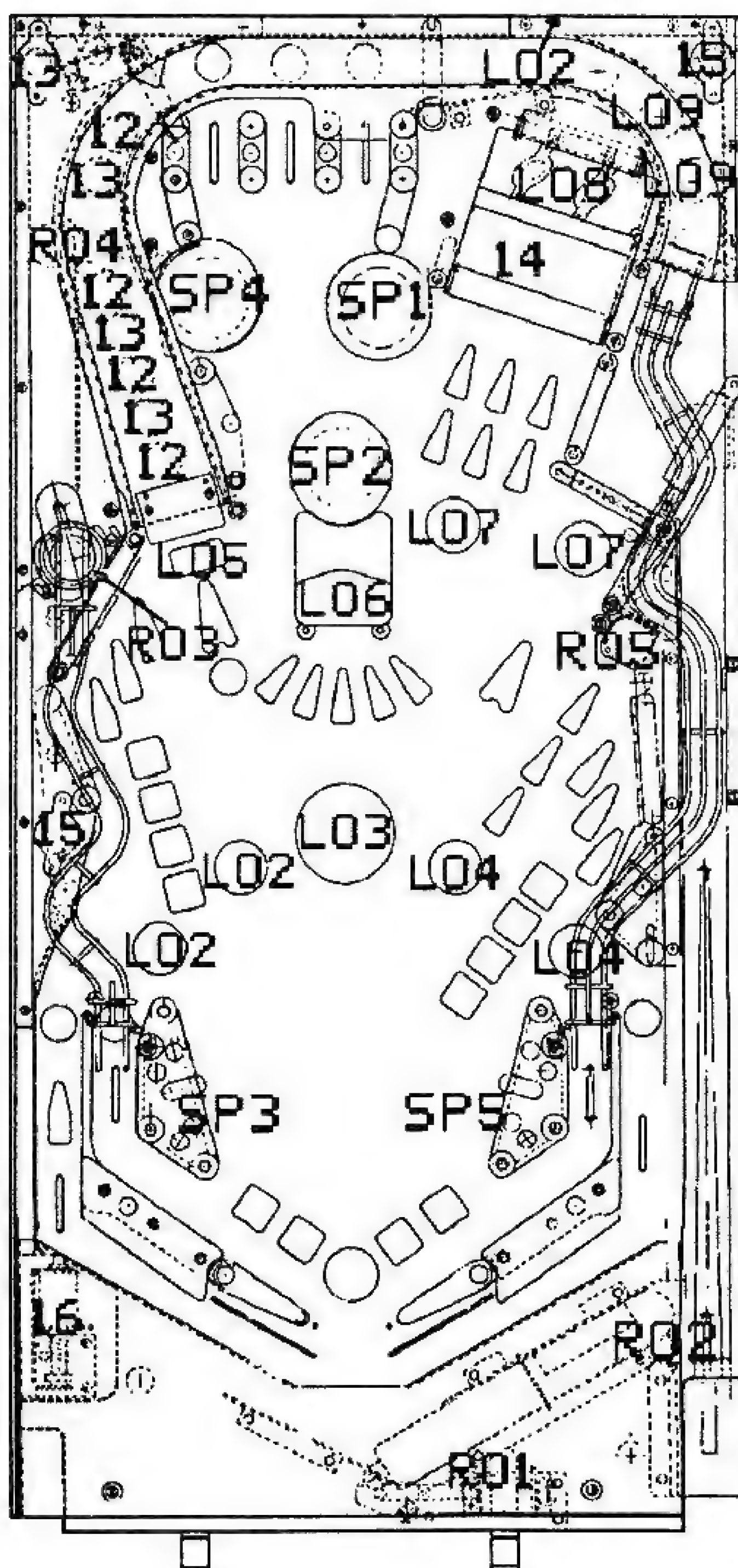
From the Discrete Lamps test, depress the STEP push-button switch. Player 1 and 2 displays indicate COIL TEST. The test pulses each regular solenoid or flash lamp sequentially with the coil/flash lamp name indicated in the Player 1 and 2 displays and the drive number in the Player 4 display.

Select Coil

From the Coil Test, depress the STEP push-button switch. Player 1 and 2 displays indicate SELECT COIL and then the name of drive 1L, the drive number is indicated in the Player 4 display. Operate the Game Start push-button switch to select the coil or flash lamp to be tested. With the desired drive number indicated in the Player 4 display, depress the STEP push-button switch to cause it to be pulsed repeatedly.

RETURN TO GAME OVER

From the Select Coil test, depress the STEP push-button switch one time if a selected coil is pulsing or two times if none is pulsing. The game returns to the game-over mode.



SWITCH TRIGGERED SOLENOIDS

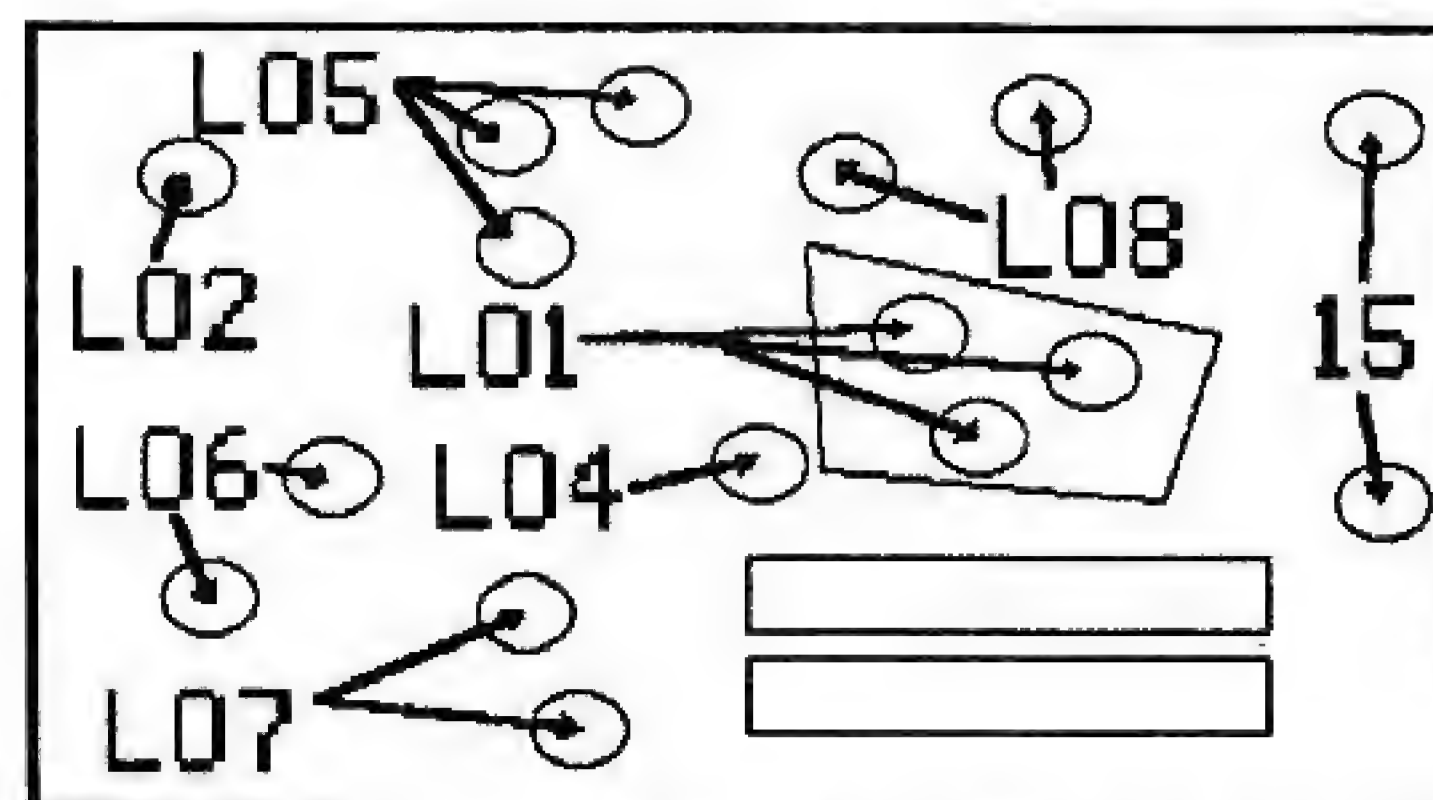
Coil Number	Coil Description	Control Line (CPU to Coil)	Power Line (PS to Coil)	Trigger Line (Coil Sw To CPU)	Drive Transistor (TIP 122)	Coil Type
SP1	Right Pop Bumper	BLU-ORN CPU CN19-3	RED PS CN3-6	ORN-BLK CPU CN 18-2	Q8	23-800
SP2	Center Pop Bumper	BLU-RED CPU CN19-4	RED PS CN3-6	ORN-RED CPU CN 18-3	Q9	23-800
SP3	Left Slingshot	BLU-YEL CPU CN19-6	RED PS CN3-6	ORN-YEL CPU CN 18-4	Q10	23-800
SP4	Left Pop Bumper	BLU-BRN CPU CN19-7	RED PS CN3-6	ORN-BRN CPU CN 18-5	Q11	23-800
SP5	Right Slingshot	BLU-GRN CPU CN19-8	RED PS CN3-6	ORN-GRN CPU CN 18-6	Q12	23-800
SP6	NOT USED	—	—	—	Q13	—

FLIPPER SOLENOIDS

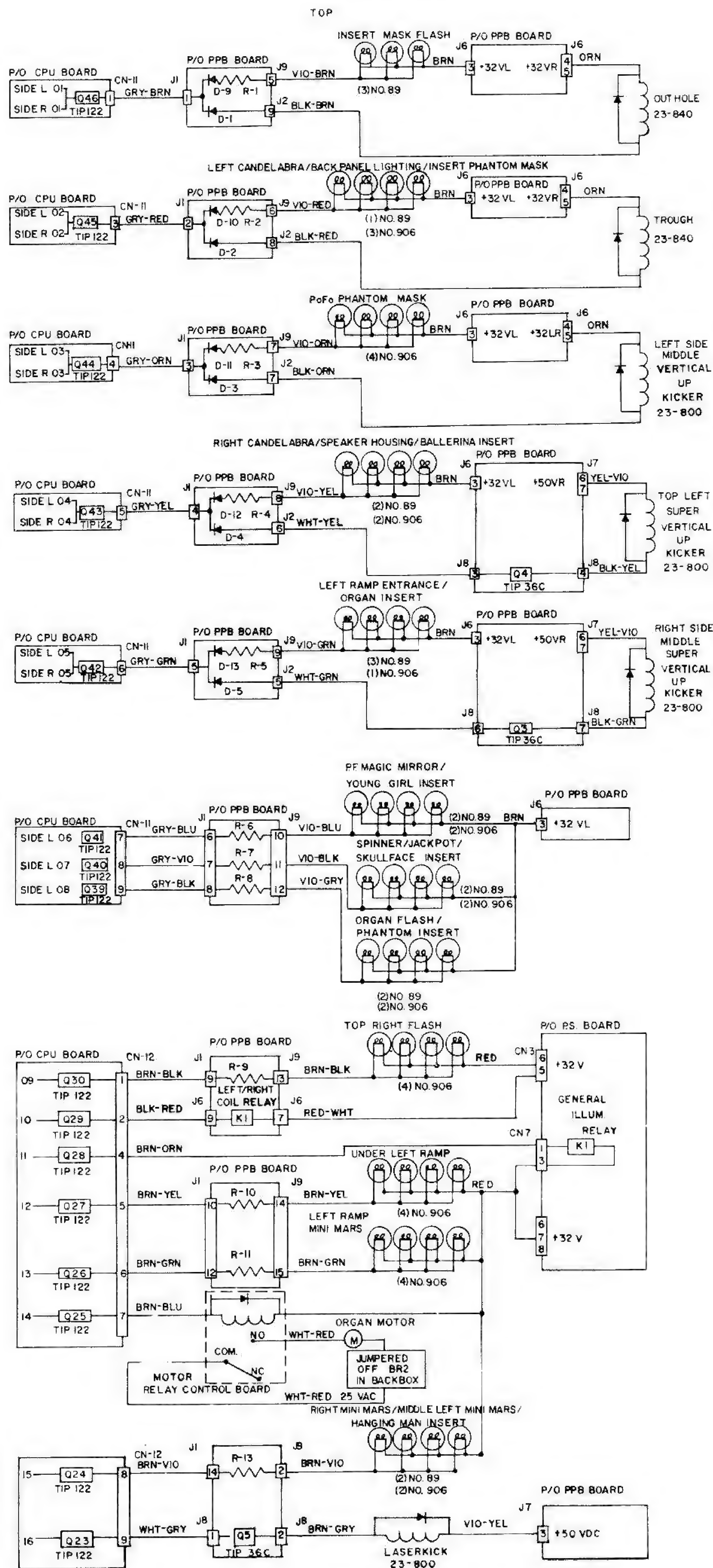
Coil Description	Flipper GND (CPU to COIL) (Switch To Flip PCB)	Power Lines (Flip PCB to Coil)	Coil Type	Power Input To Flip PCB
Left Flipper	ORN-GRY CPU CN19-2	BLU-GRY CN1-9	23-900	BLK-WHT 50VDC
Right Flipper	ORN-VIO CPU CN19-1	BLU-VIO CN1-1	23-900	GRY-GRY GRN 8VAC

PHANTOM OF THE OPERA COIL PART NUMBER CHART

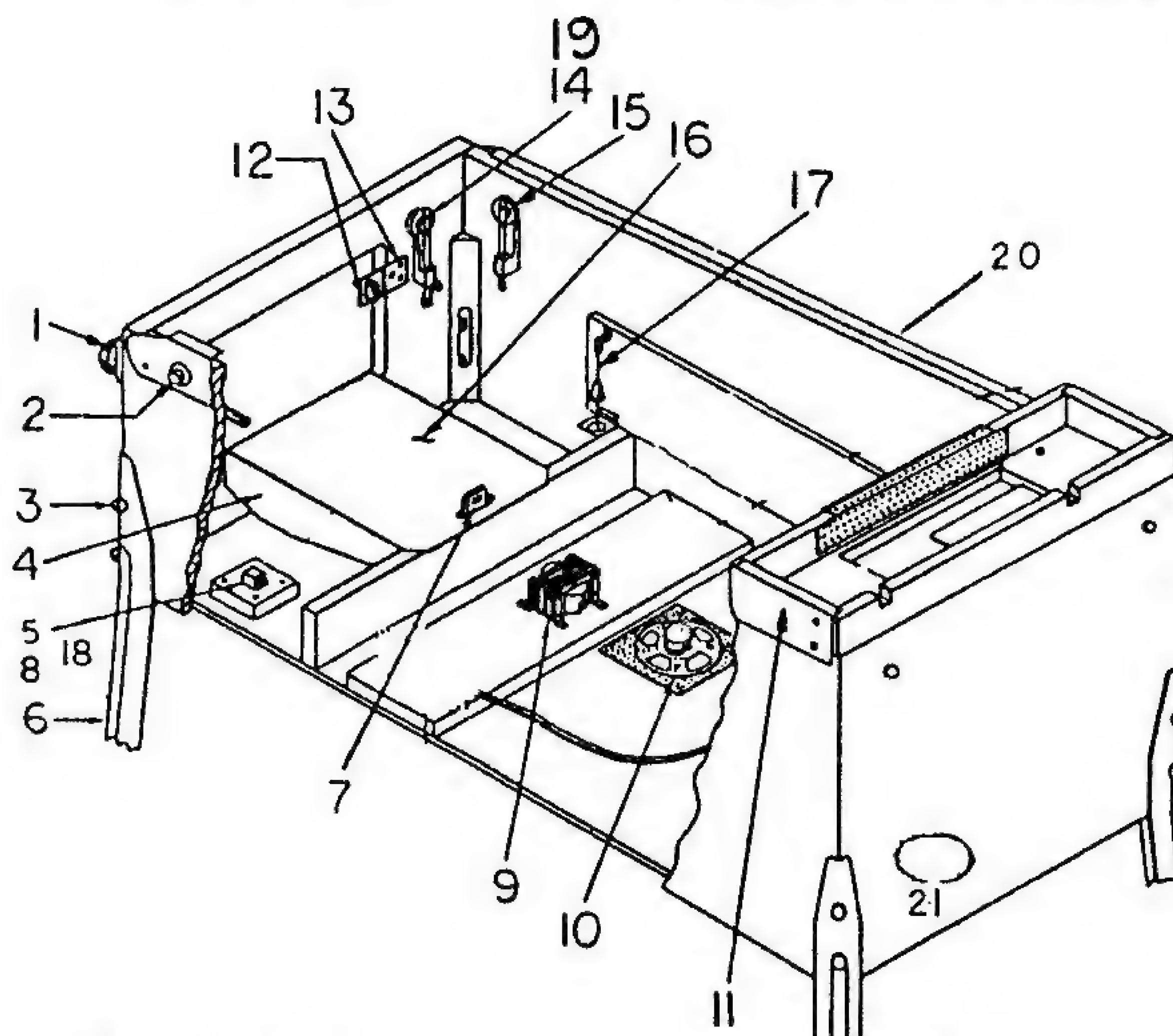
QUANTITY USED	COIL TYPE	DATA EAST PINBALL PART NUMBER
9	23-800	090-5001-00
2	23-840	090-5006-00
2	23-900	090-5020-30



Backbox Flash lamps



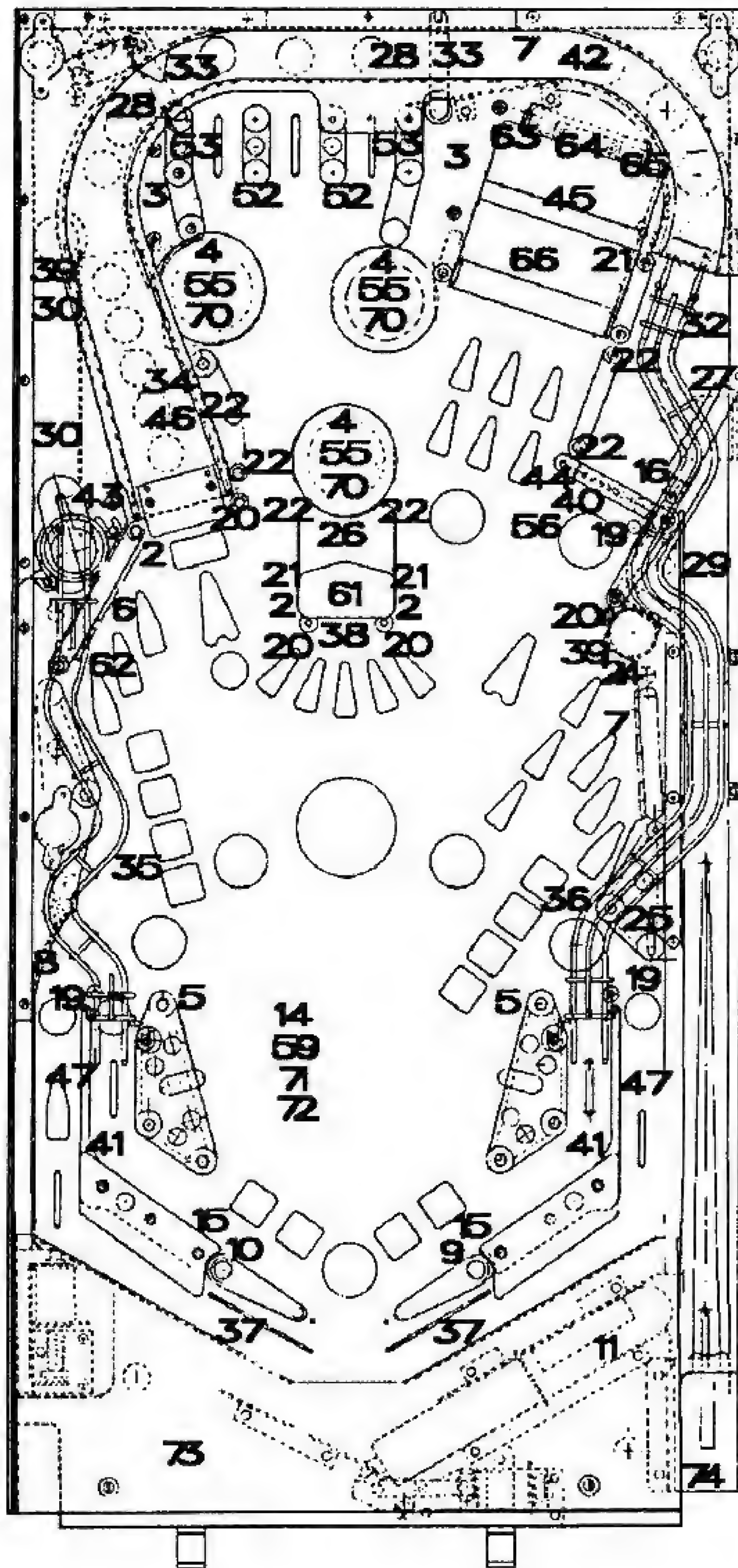
CABINET PARTS ILLUSTRATION



Item	Description	Part No.
1	Ball-shooter Assy	500-5019-04
2	Flipper Button	500-5026-22
3	Leg Bolt (Chrome)	231-5000-01
4	Cash Box Bottom	545-5090-00
5	On/Off Switch DP/ST	180-5001-00
6	Leg (Black)	535-5020-30
7	Lock Bracket-Cash Box	535-5215-00
8	Power Input Box Assy	515-5153-01
9	Transformer	010-5002-00
10	Speaker-Round (6")	031-5000-00
11	Side Armor-Right	535-5010-11
12	Memory Protect Switch	180-5000-00
13	Memory Protect Switch Bracket	535-5225-00
14	Start Switch	500-5097-00
15	Flipper Micro Switch Assembly	500-5251-00
16	Cash Box Top	535-5013-01
17	Plumb Bob Tilt	535-5029-00
18	Volume Control	123-5000-00
19	Playfield Glass (Tempered)	660-5001-00
20	Side Armor -Left	535-5010-12
21	Line Cord Receptacle	545-5122-00
22	Service Switch (Not Shown)	180-5012-00
23	Front Molding Lockdown Assy.	500-5020-00
24	Front Molding -Black (Not Shown)	500-5021-10
25	S.S.Flipper P.C.B. (Not Shown)	520-5033-00

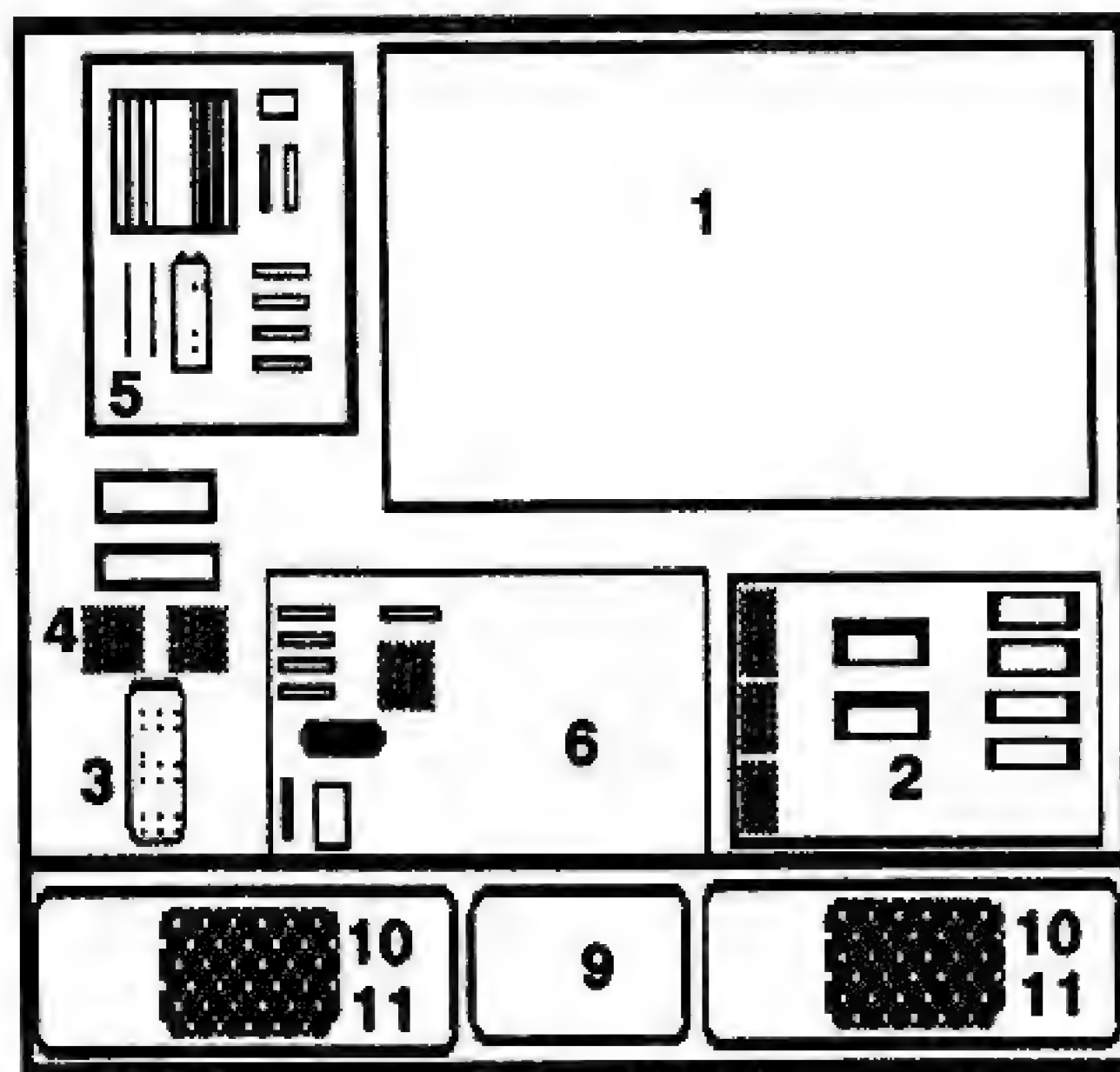
Playfield Parts

Number	Description	Part Number
1.	Organ Motor	041-5001-00
2.	$\frac{5}{8}$ " Hex Spacer (4)	254-5008-02
3.	$\frac{1}{2}$ " Hex Spacer (8)	254-5008-03
4.	Turbo Bumper (3)	500-5034-10
5.	Slingshot (2)	500-5077-00
6.	3 Bank Stand Up Tgt. Assy	500-5103-18
7.	Top Ball Guide	500-5155-00
8.	Left Outlane Ball Guide	500-5157-00
9.	Right Flipper	500-5177-31
10.	Left Flipper	500-5177-32
11.	Sw. Plate	500-5190-00
12.	Hood Assembly	500-5205-00
13.	Target Cover	500-5209-00
14.	Complete Assm.Playfield	505-6004-00
15.	Flipper Bat & Shaft (2)	515-5133-00
16.	Spinner Target	515-5236-00
17.	Butyrate Assy.	830-5407-XX
18.	Relay Board	520-5010-00



19.	Mini Post (3)	530-5004-00
20.	Bumper Post (7)	530-5007-00
21.	Metal Standoff (3)	530-5035-01
22.	Metal Standoff (9)	530-5035-02
23.	Bumper Post	530-5057-00
24.	Ball Return Ramp	535-5026-00
25.	Outlane Adjustable Plate	535-5091-00
26.	Ball Stop Bracket	535-5217-00
27.	Mounting Bracket	535-5269-01
28.	Mounting Bracket (2)	535-5269-02
29.	2 $\frac{1}{2}$ " Ball Guide Wire	535-5300-01
30.	3" Ball Guide Wire (2)	535-5300-02
31.	1" Ball Guide Wire (3)	535-5300-05
32.	Ball Shooter Wire Gate	535-5307-01
33.	Wire Gate (3)	535-5307-02
34.	Ramp Entrance Wire Gate	535-5354-01
35.	L. Wire Ramp	535-5366-00
36.	R. Wire Ramp	535-5367-00
37.	Flipper Snubber Wire (2)	535-5373-01
38.	Mirror Target	535-5374-00
39.	Ball Deflector (2)	535-5380-00
40.	Spinner Actuator Wire	535-5387-00
41.	Ball Guide (2)	535-5406-02
42.	Ball Guide	535-5439-00
43.	Ball Guide Wire	535-5440-00
44.	Spinner Mounting Bracket	535-5752-01
45.	Organ Flash Lamp Cover	535-5788-00
46.	Ramp Wire Mtg.Bracket	535-5792-00
47.	Ball Guide Outlins/Return(2)	535-5793-00
48.	Up. Subway Rmp R.Ball Def.	535-5800-01
49.	Up. Subway Rmp L.Ball Def.	535-5800-02
50.	Red Mini Mars (3)	545-5004-02
51.	Amber Mini Mars (2)	545-5004-03
52.	Red 2 Sided Lite Hood (2)	545-5011-02
53.	Red Sngle Sided Lite Hood(2)	545-5012-02
54.	1 $\frac{1}{16}$ " Red Jeweled Post (28)	545-5013-02
55.	Turbo Bumper Cap (3)	545-5035-32
56.	Spinner Washers (2)	545-5037-00
57.	Mid. Playfield Subway Ramp	545-5143-00
58.	Top Playfield Subway Ramp	545-5144-00
59.	Playfield Glass	660-5001-00
60.	Ramp Decal Sheet	820-5024-00
61.	Mirror Target Decal	820-5026-00
62.	Target Decal (3)	820-5108-01
63.	Left Organ Target	820-5108-02
64.	Middle Organ Target	820-5108-03
65.	Right Organ Target	820-5108-04
66.	Inside Organ Phantom Decal	820-5109-00
67.	Top of Organ Decal	820-5109-01
68.	Spinner Decal Front	820-5208-01
69.	Spinner Decal Rear	820-5208-02
70.	Turbo Bumper Decal (4)	820-5308-00
71.	Playfield Mylar Overlay	820-5808-00
72.	Screened Playfield	830-5108-00
73.	Bottom Arch	830-5508-01
74.	Shooter Guage	830-5508-02

BACKBOX PARTS ILLUSTRATION

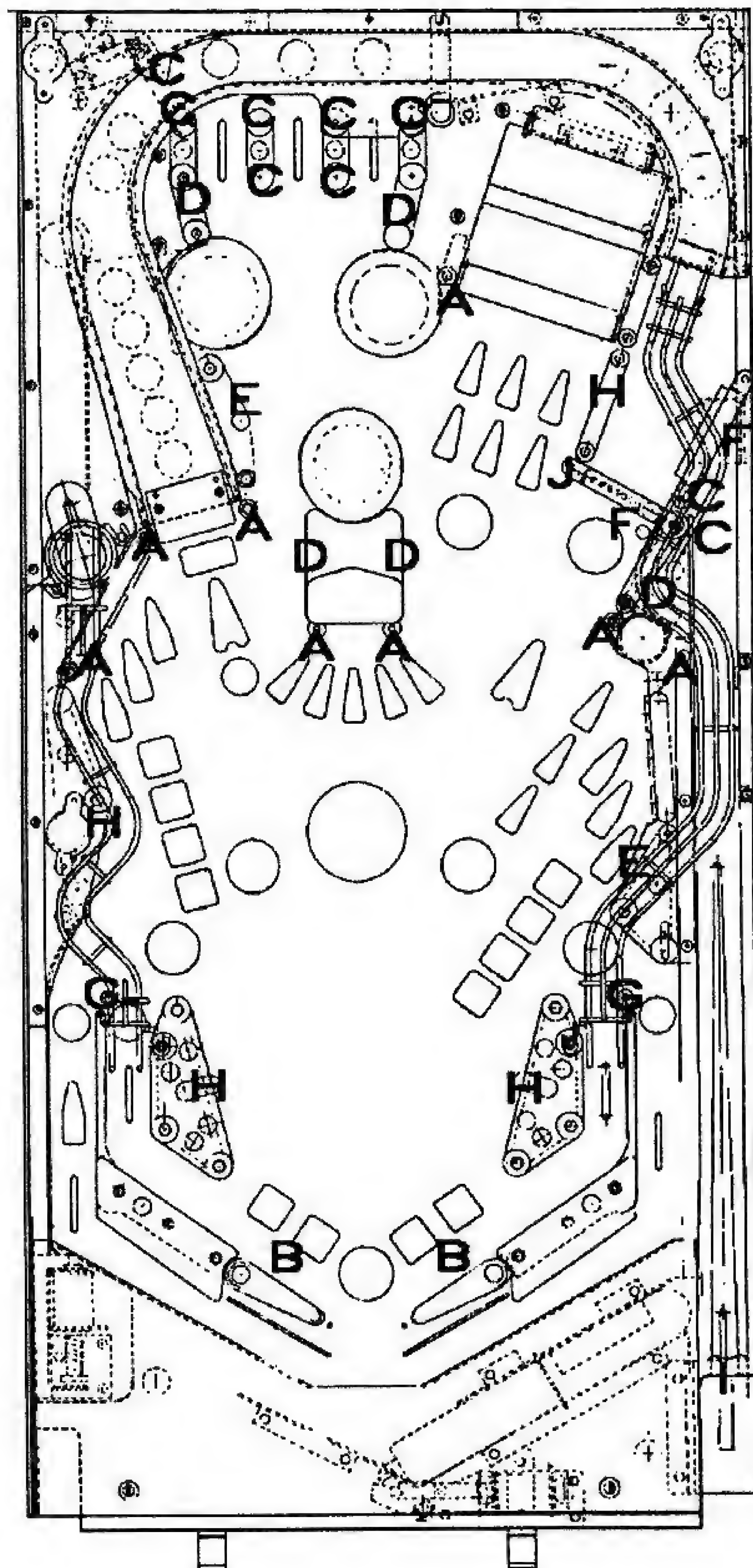


Item	Description	Part No.
1	CPU Board Assy.	520-5003-08
2	Sound Board Assy	520-5002-08
3	Capacitor 2C1	125-5000-00
4	Bridge Rectifiers	112-5000-00
5	Power Supply Bd. Assy	520-5000-00
6	PPB Board	520-5021-08
7	Combined Display Bd Assy*	520-5030-00
8	Display Ribbon Cable*	036-5001-30
9	Speaker Housing	515-5215-00-08
10	Speakers (2)	031-5003-00
11	Speaker Grill (2)	545-5086-00
12	Back Box Glass*	830-5208-00

* Not Shown

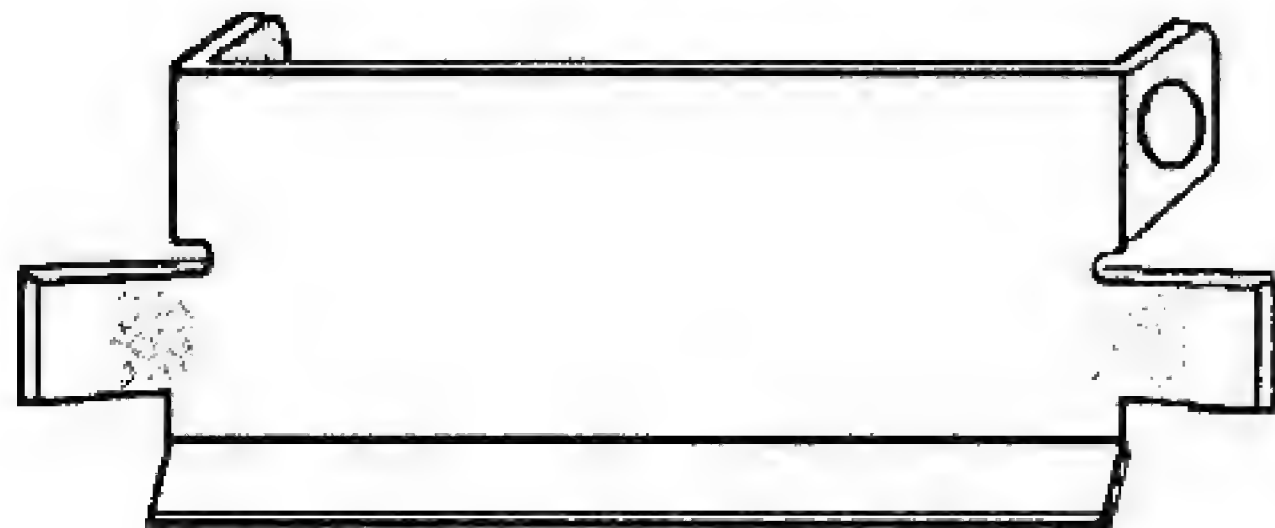
RUBBER PARTS ILLUSTRATION

Item	Description	Part #
A.	Black Rubber Post (8)	545-5009-00
B.	Red Flipper (2)	545-5024-02
C.	$\frac{5}{16}$ " (9)	545-5025-02
D.	1" (5)	545-5025-05
E.	2" (2)	545-5025-08
F.	$\frac{7}{16}$ " Outer Diameter (2)	545-5025-17
G.	$\frac{3}{8}$ " Outer Diameter (2)	545-5025-19
H.	2 $\frac{3}{4}$ " (4)	545-5025-20
I.	Shooter Tip (1)	545-5027-00
J.	Rubber Post(1)	545-5151-00

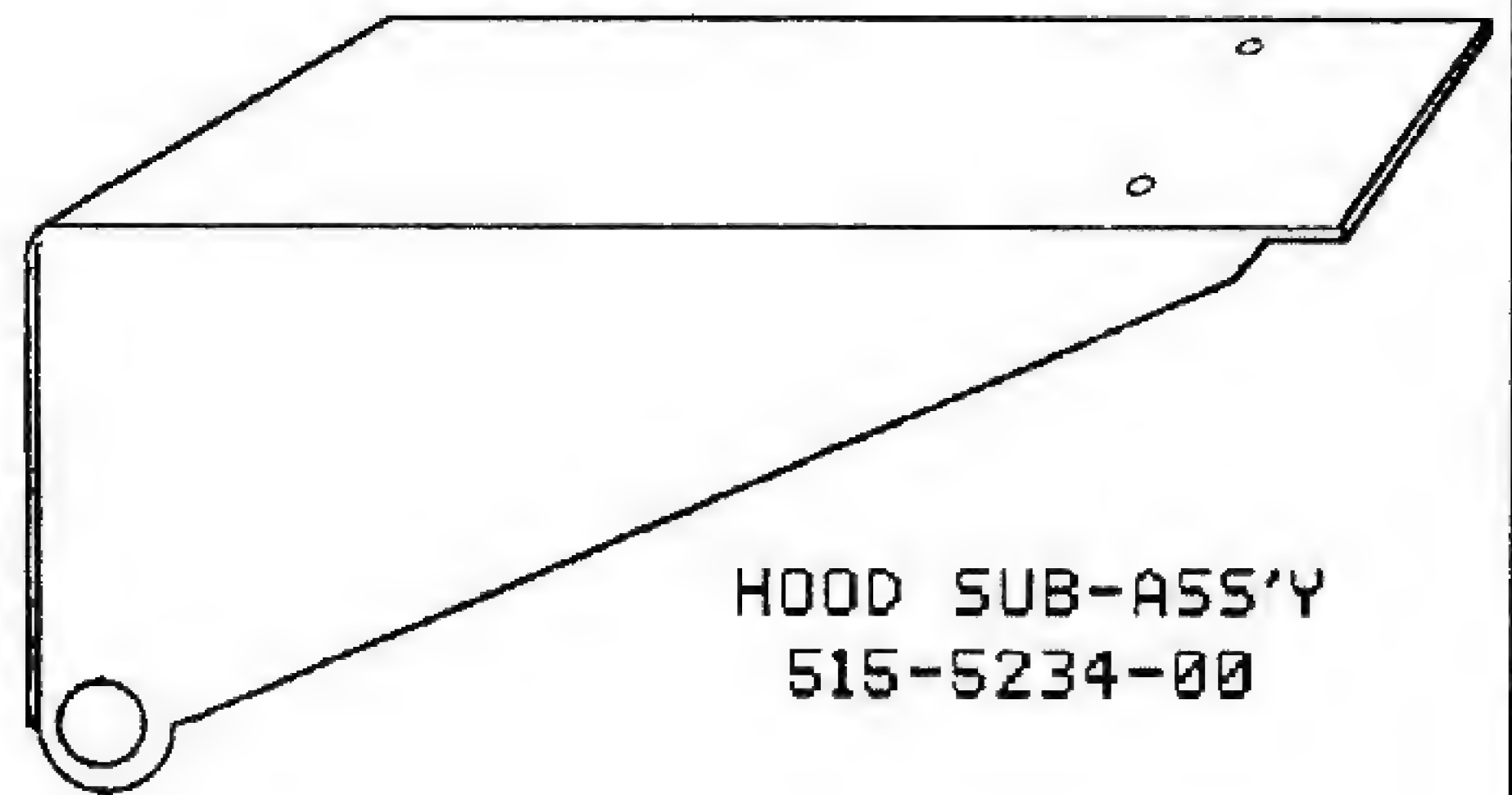


Unique Parts

BALL DEFLECTOR
535-5812-00



HOOD SUB-ASS'Y
515-5234-00



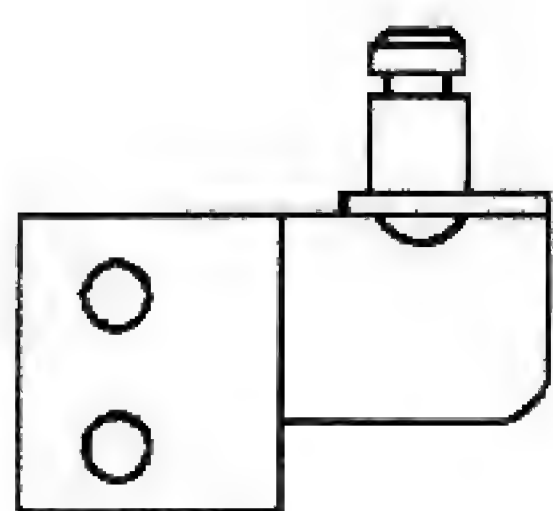
CRANK ARM LEVER
535-5775-00



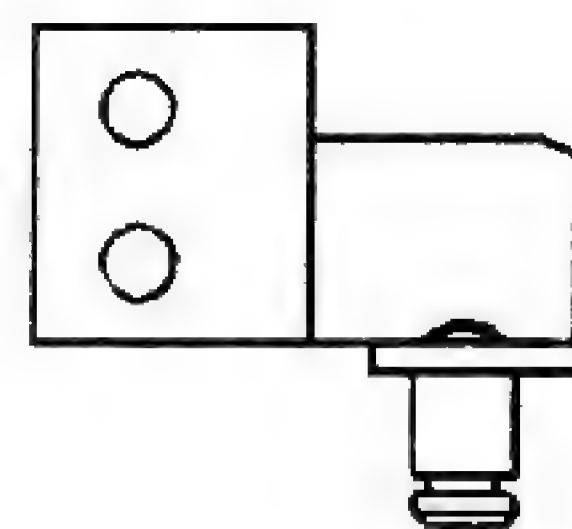
HOOD MTG. BRK'T
535-5774-00



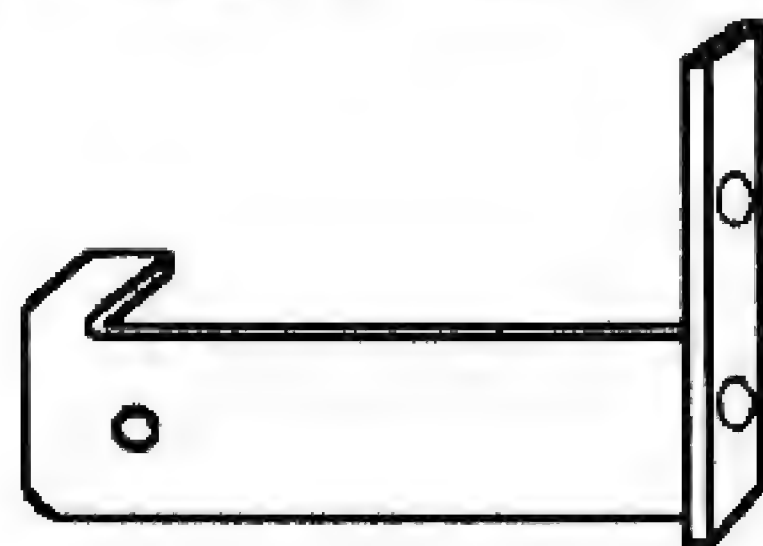
HINGE BRK'T
ASSY (LEFT)
515-5260-00



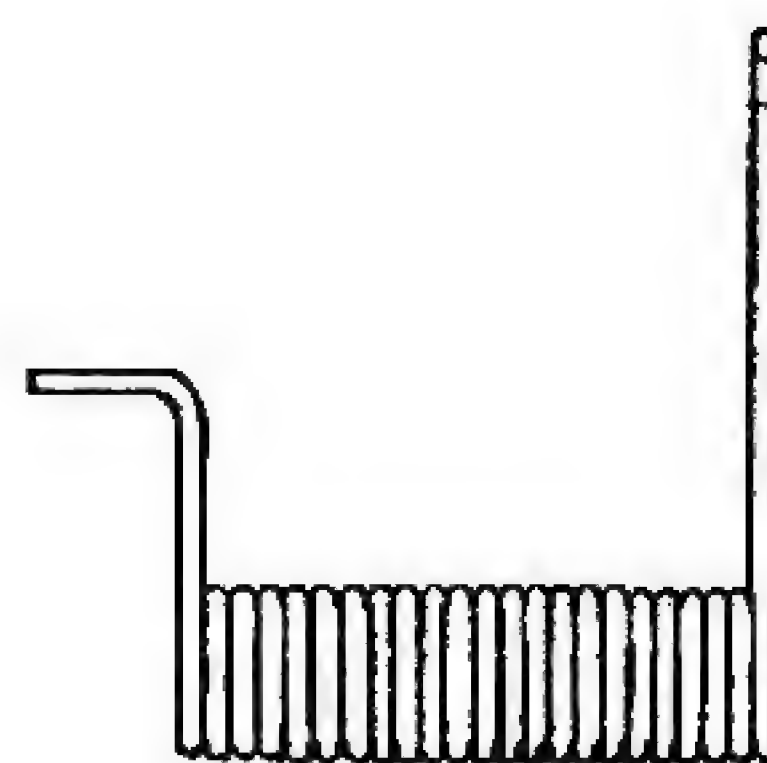
HINGE BRK'T
ASSY (RIGHT)
515-5261-00



MIRROR MTG. BRK'T
535-5375-01 LEFT
535-5375-02 RIGHT



LEFT (SHOWN)



MAGIC MIRROR
TARGET RETURN SPRING
265-5011-00

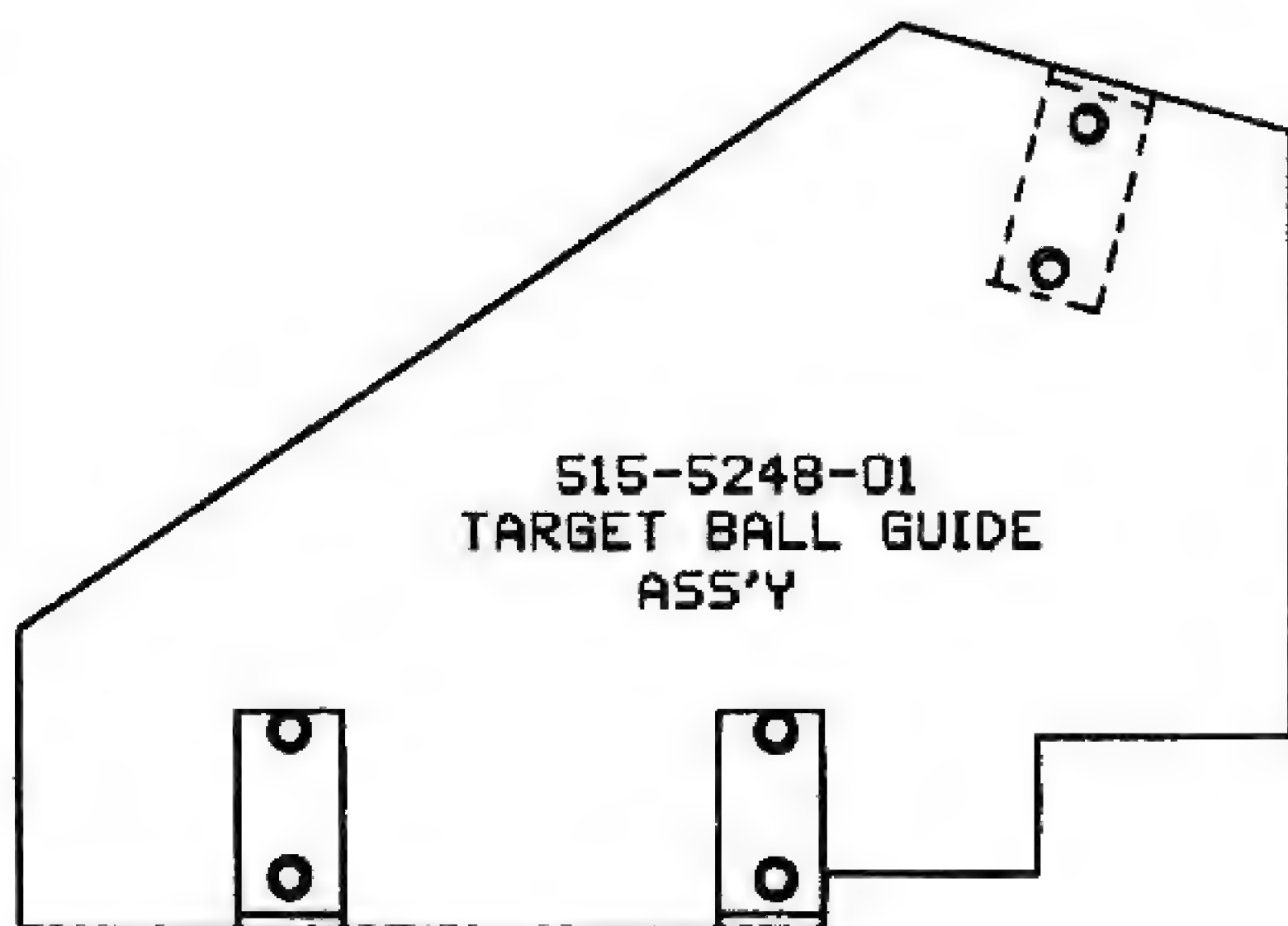
MIRROR HINGE PIN
535-5376-00



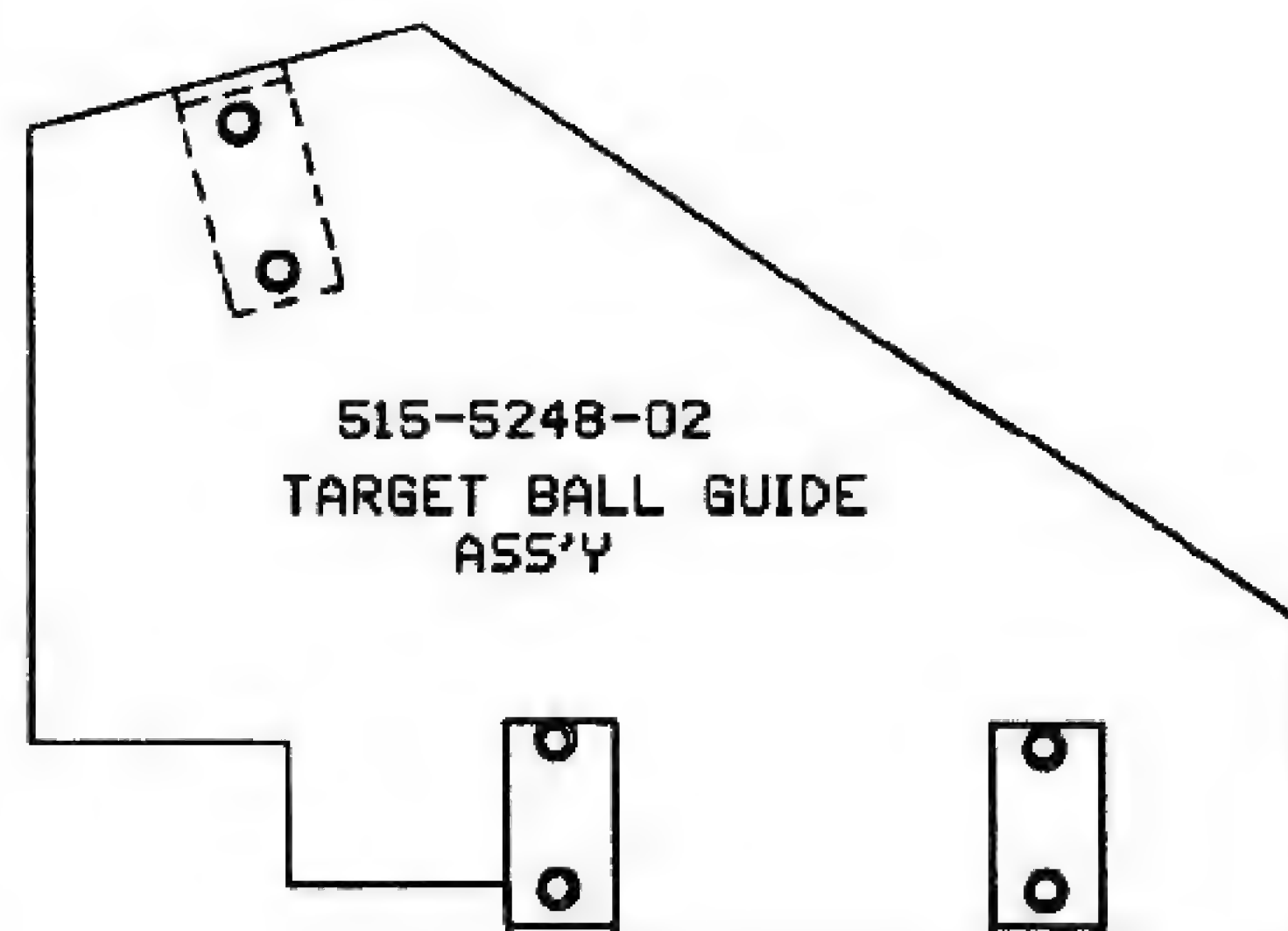
PIVOT SHAFT
530-5088-00



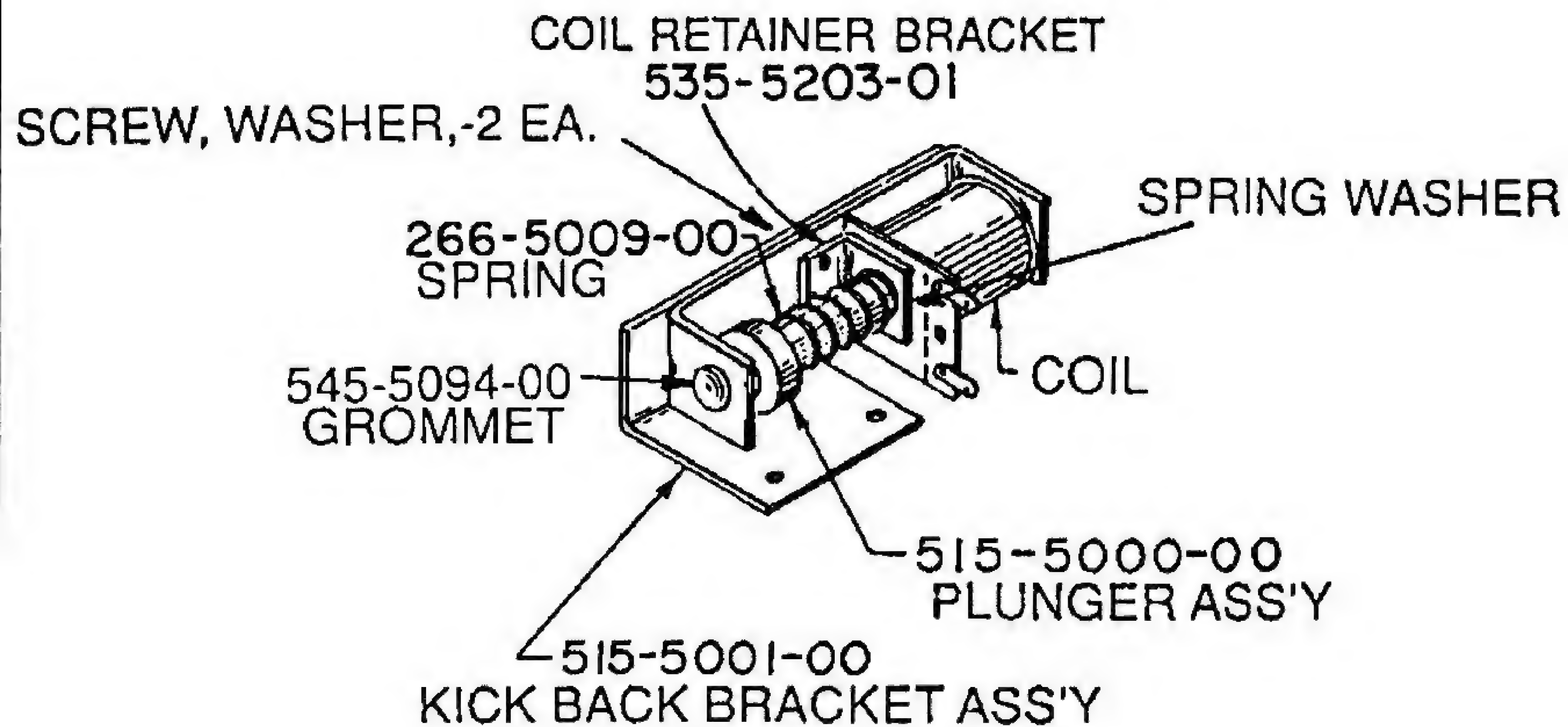
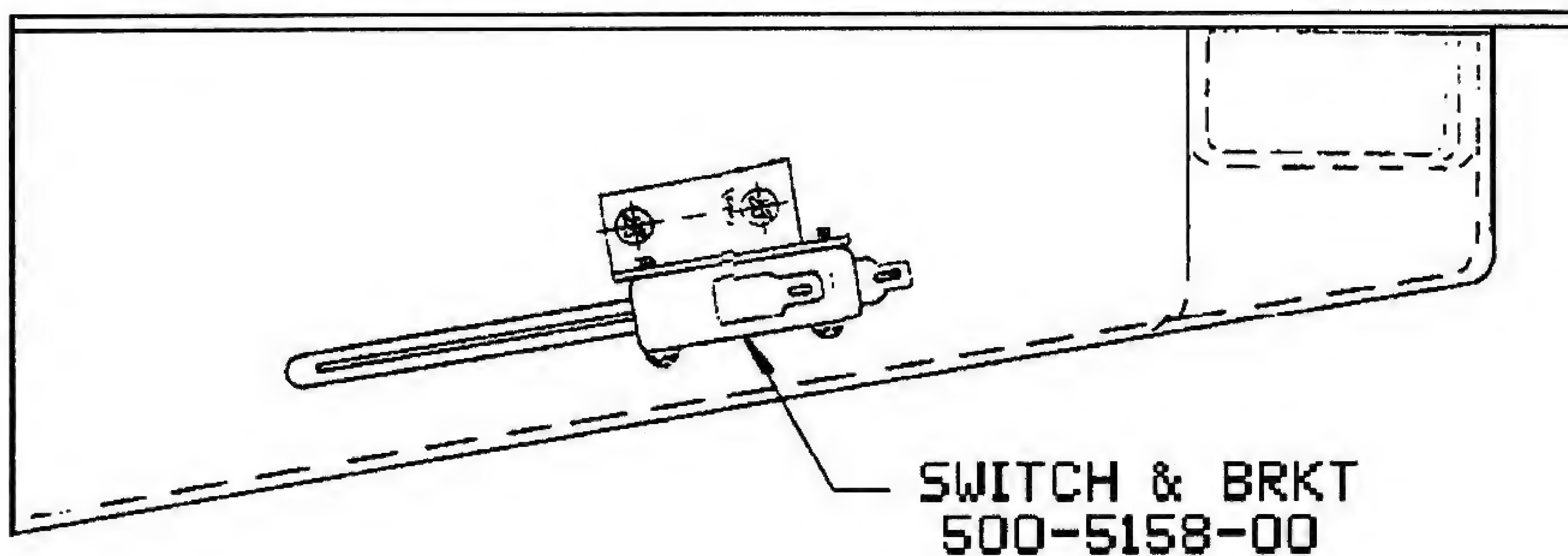
515-5248-01
TARGET BALL GUIDE
ASS'Y



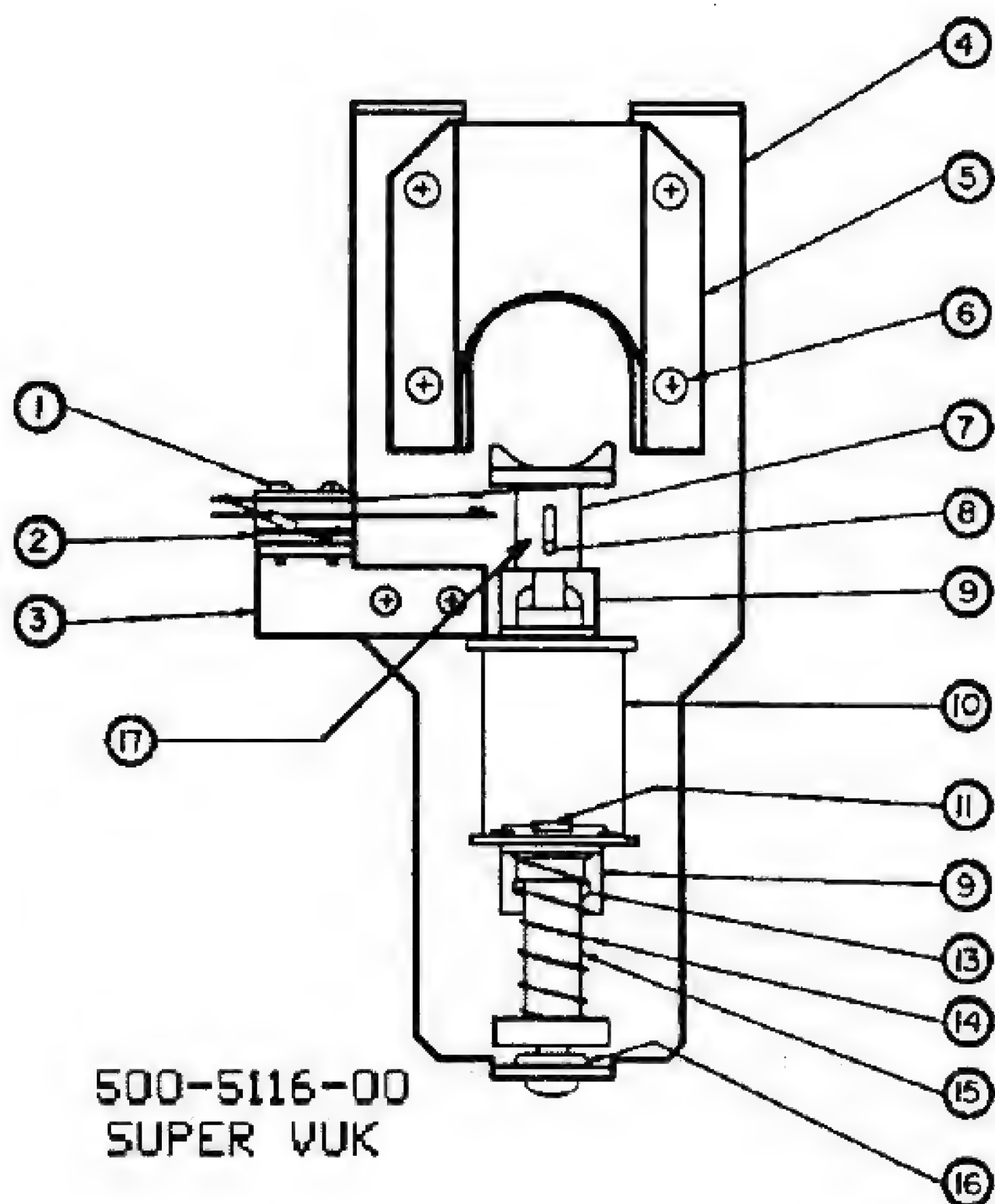
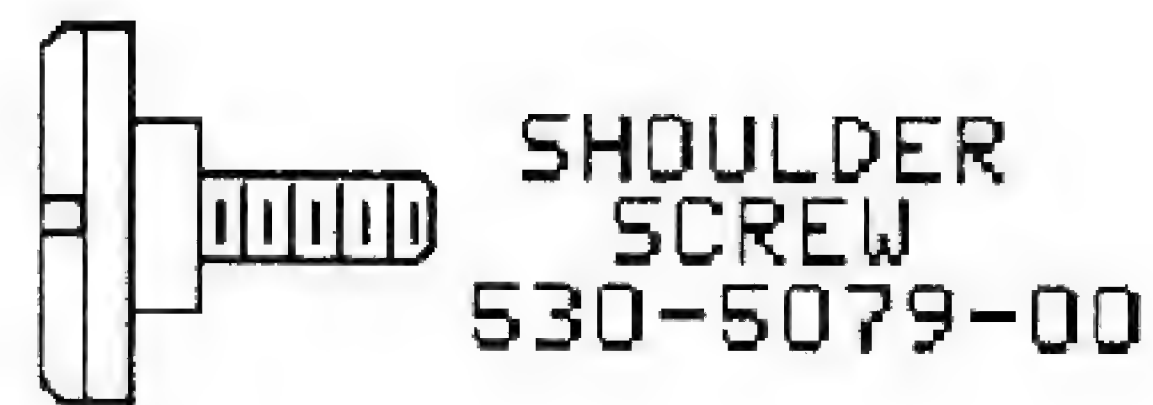
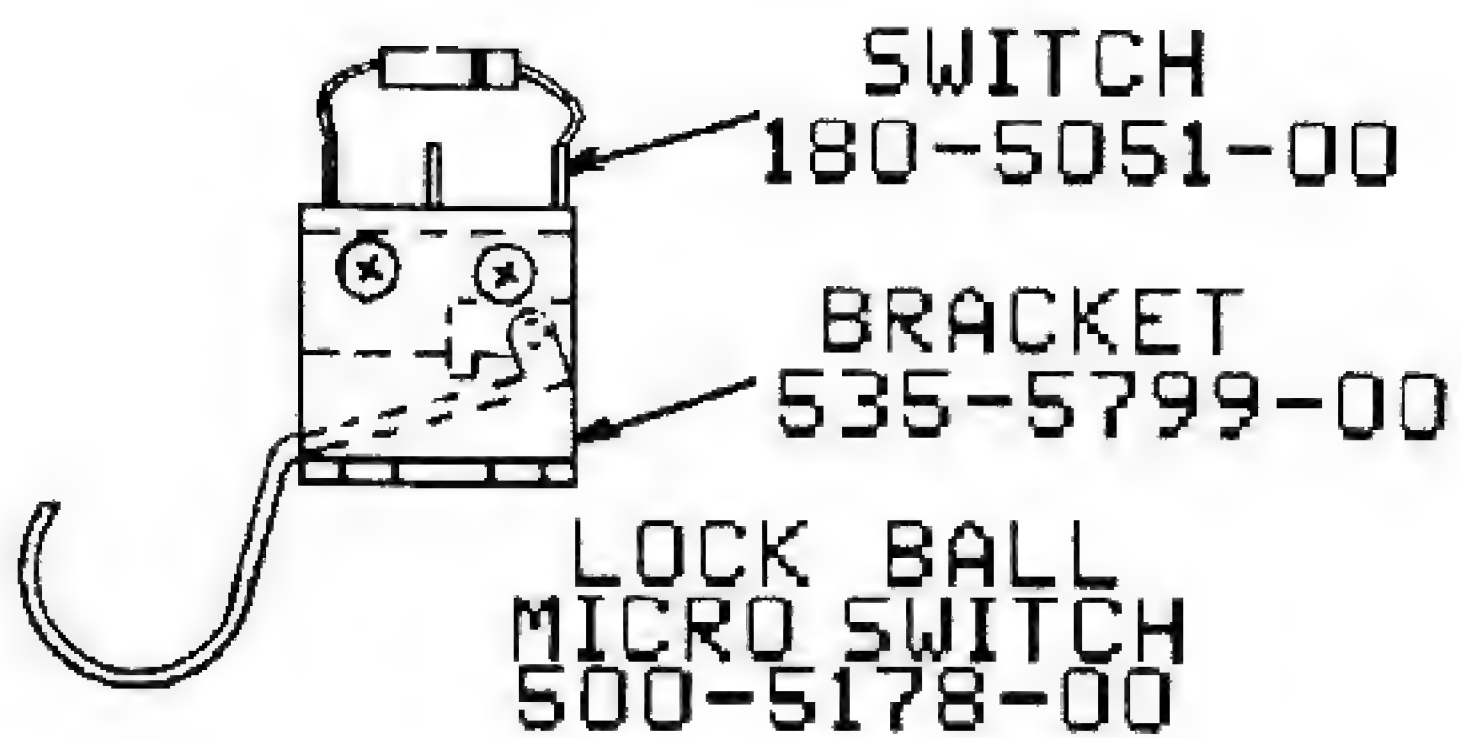
515-5248-02
TARGET BALL GUIDE
ASS'Y



RAMP & SWITCH ASSY.
500-5156-00

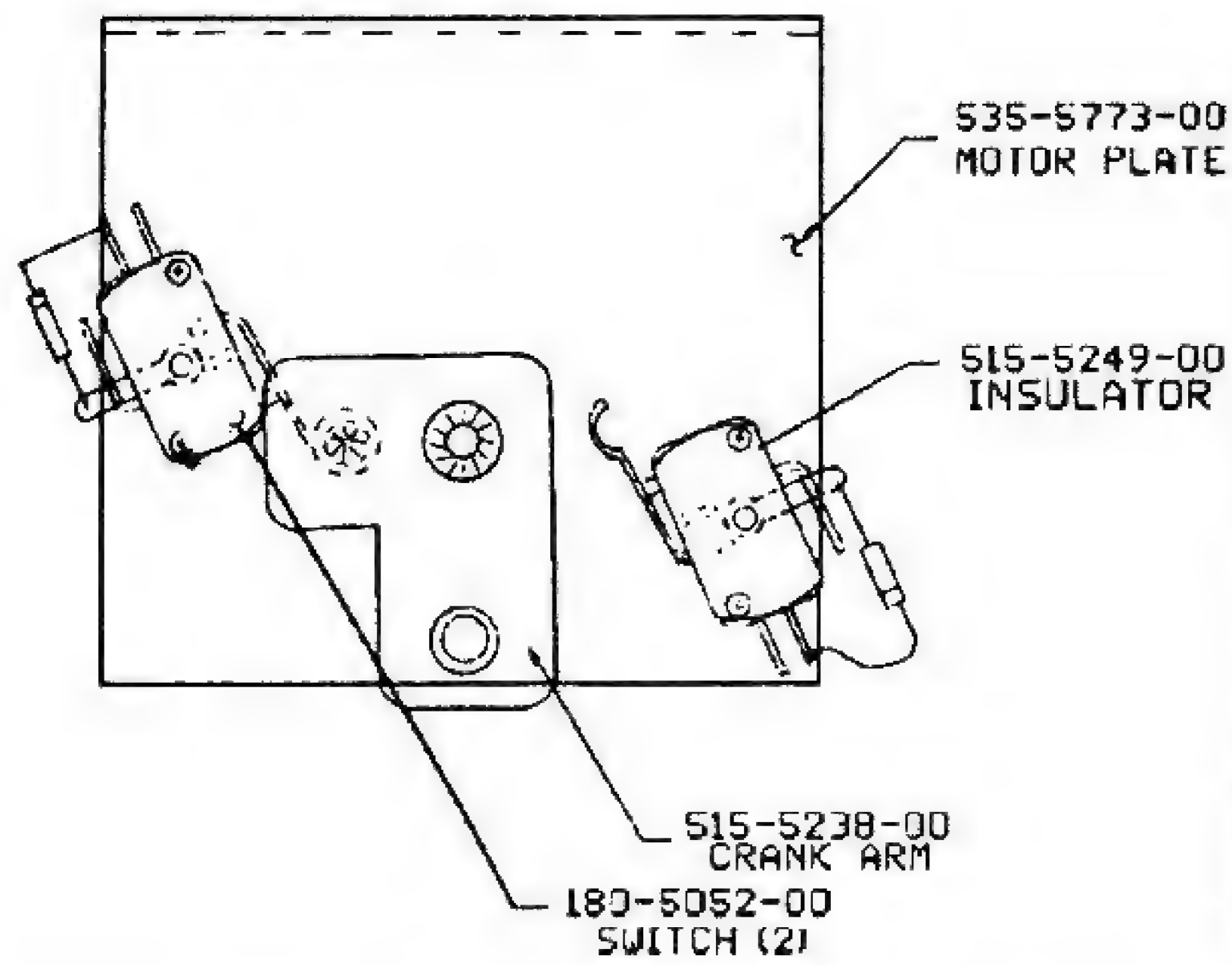


500-5080-00 KICKBACK ASSEMBLY

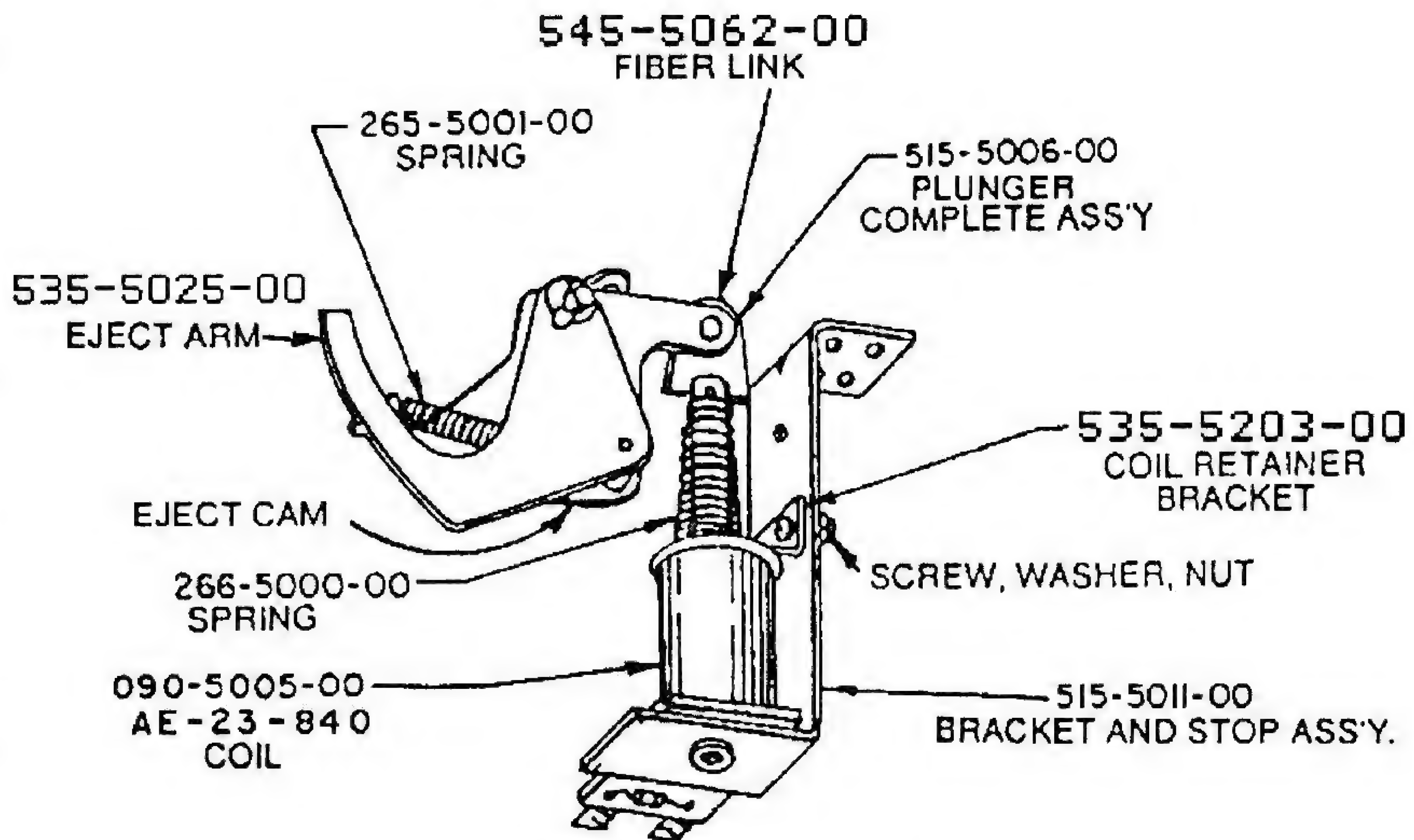
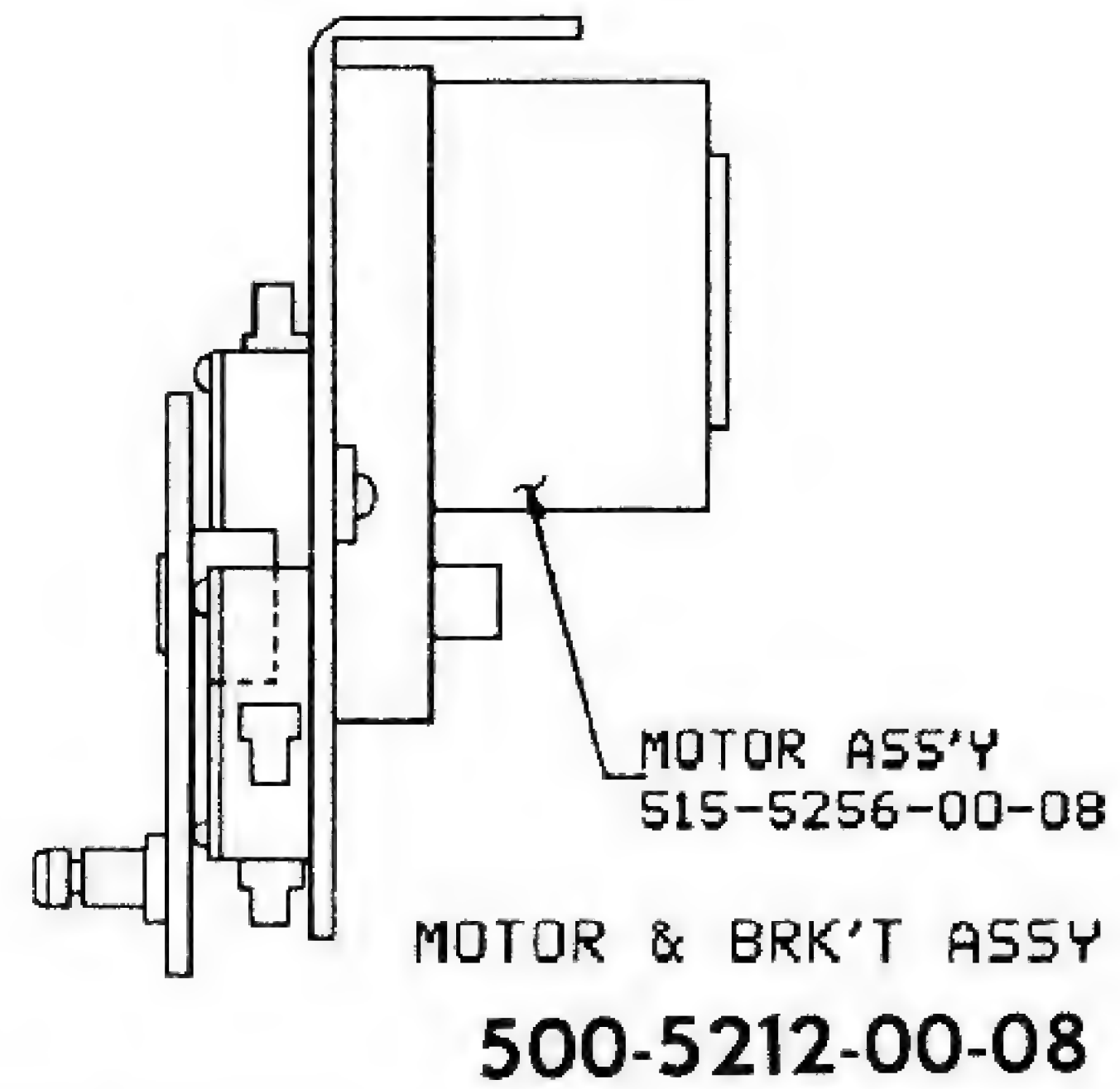


Item	Part #	Description
1		#4-40x ⁹ / ₁₆ Mach.Screw
2	180-5041-00	Switch Assembly
3	535-5290-00	Ball Kickup Sw. Bracket
4	535-5298-00	Ball Kickup Mtg. Bracket
5	535-5427-00	Ball Guide
6		#8-32x ¹ / ₄ Mach.Screw
7	545-5073-00	Vert. Kick Cap
8		.094 x .500 Pin
9	535-5203-01	Coil Retainer Bracket
10	090-5001-01	Coil 23-800
11	112-5003-00	1N4004 Diode
12	535-5110-00	Brace (Not Shown)
13	232-5200-00	#6-32x1/4 Phil.Mach.Sc.
14	266-5009-00	Spring
15	515-5096-00	Plunger Assy
16	515-5003-00	Bumper
17	270-5010-00	Retaining Clip

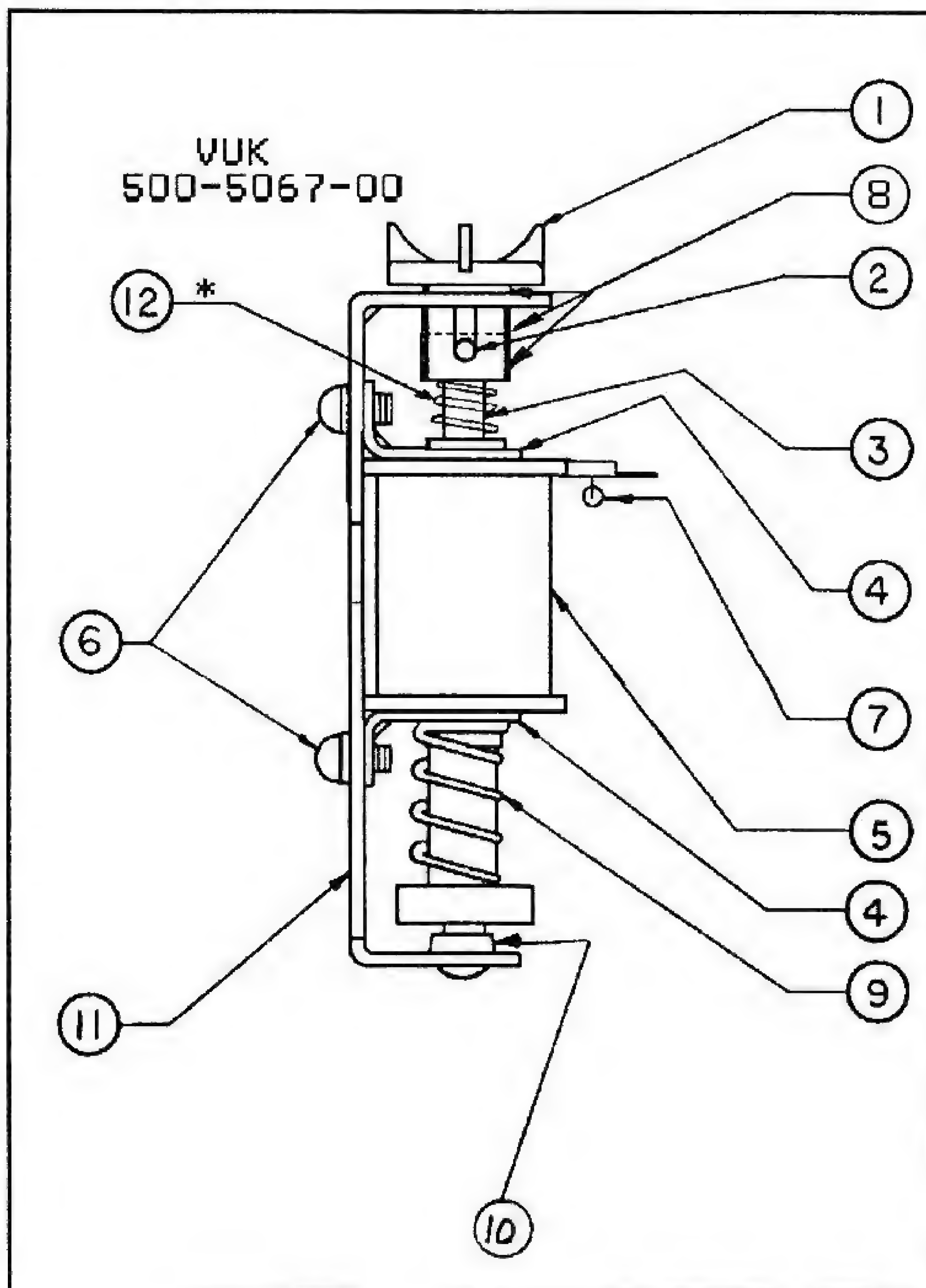
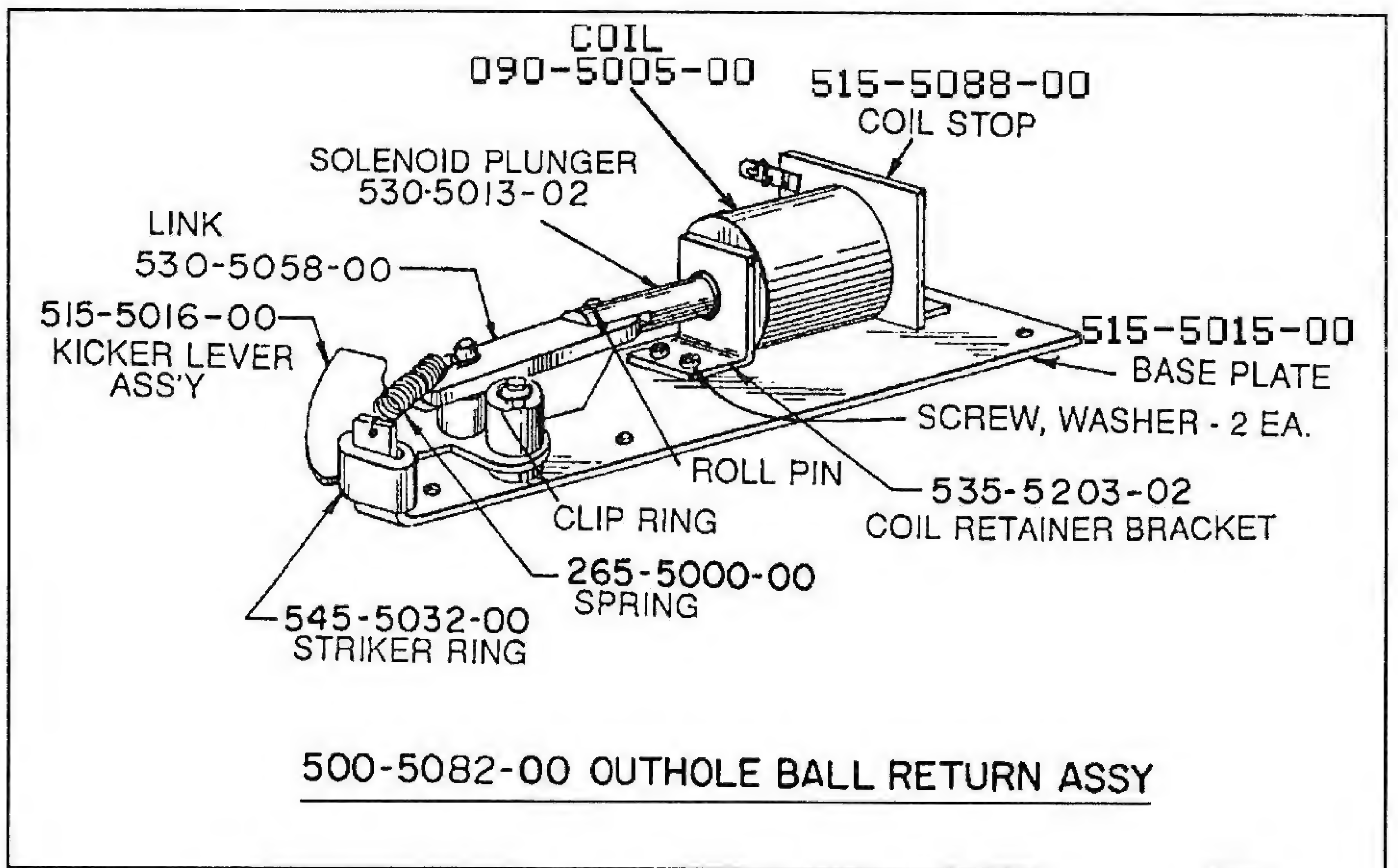
FRONT VIEW



SIDE VIEW

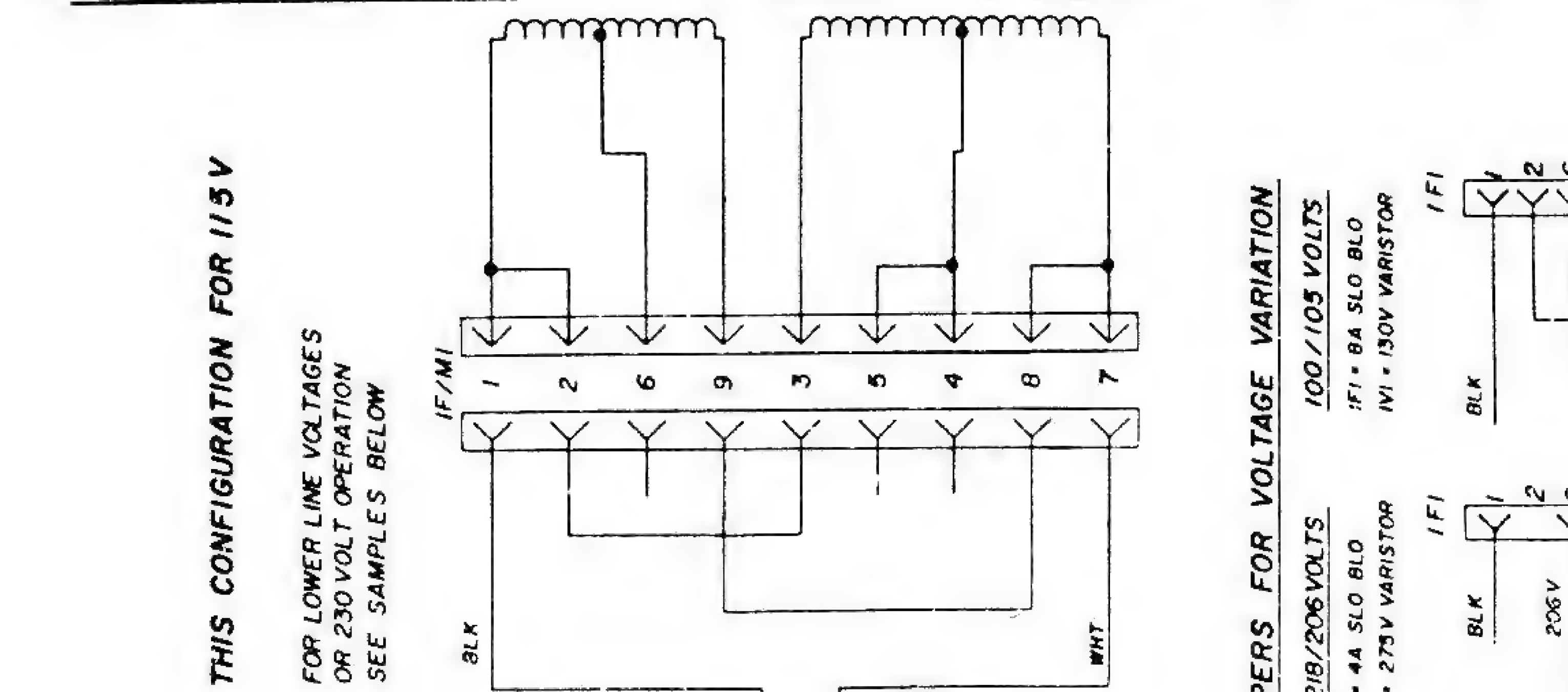


500-5012-00 BALL FEED ASSY.

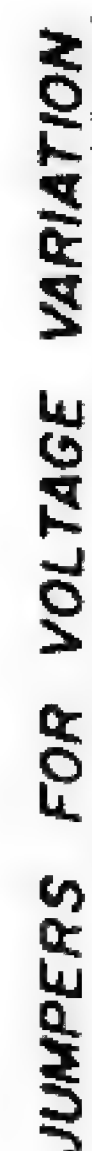


Item	Part #	Description
1	545-5078-00	Vert.Kick.Cap
2	535-5111-00	Pin .094x.500
3	515-5096-00	Plunger Assy.
4	535-5203-01	Coil Retainer Brkt.(2)
5	090-5001-01	Coil 23-800
6	#8-32x 1/4" LG.	Phillips Screw (4)
7	112-5003-00	1N4004 Diode
8	270-5010-00	Compression Ring(3)
9	266-5009-00	Spring
10	280-5003-00	Bumper
11	535-5271-00	VUK Bracket
12	265-5016-00	Cap Spring *

* Spring added when used with Microswitch

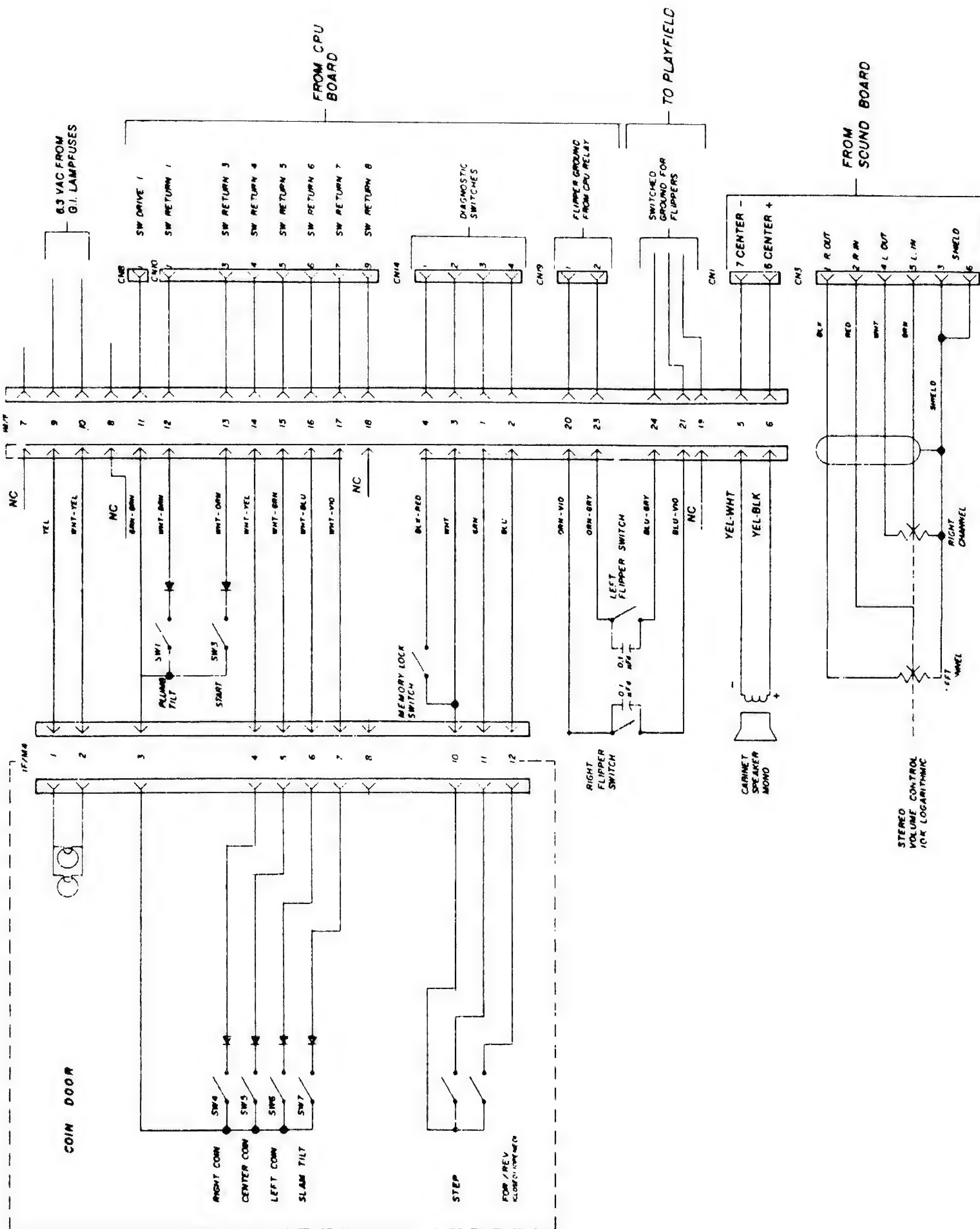


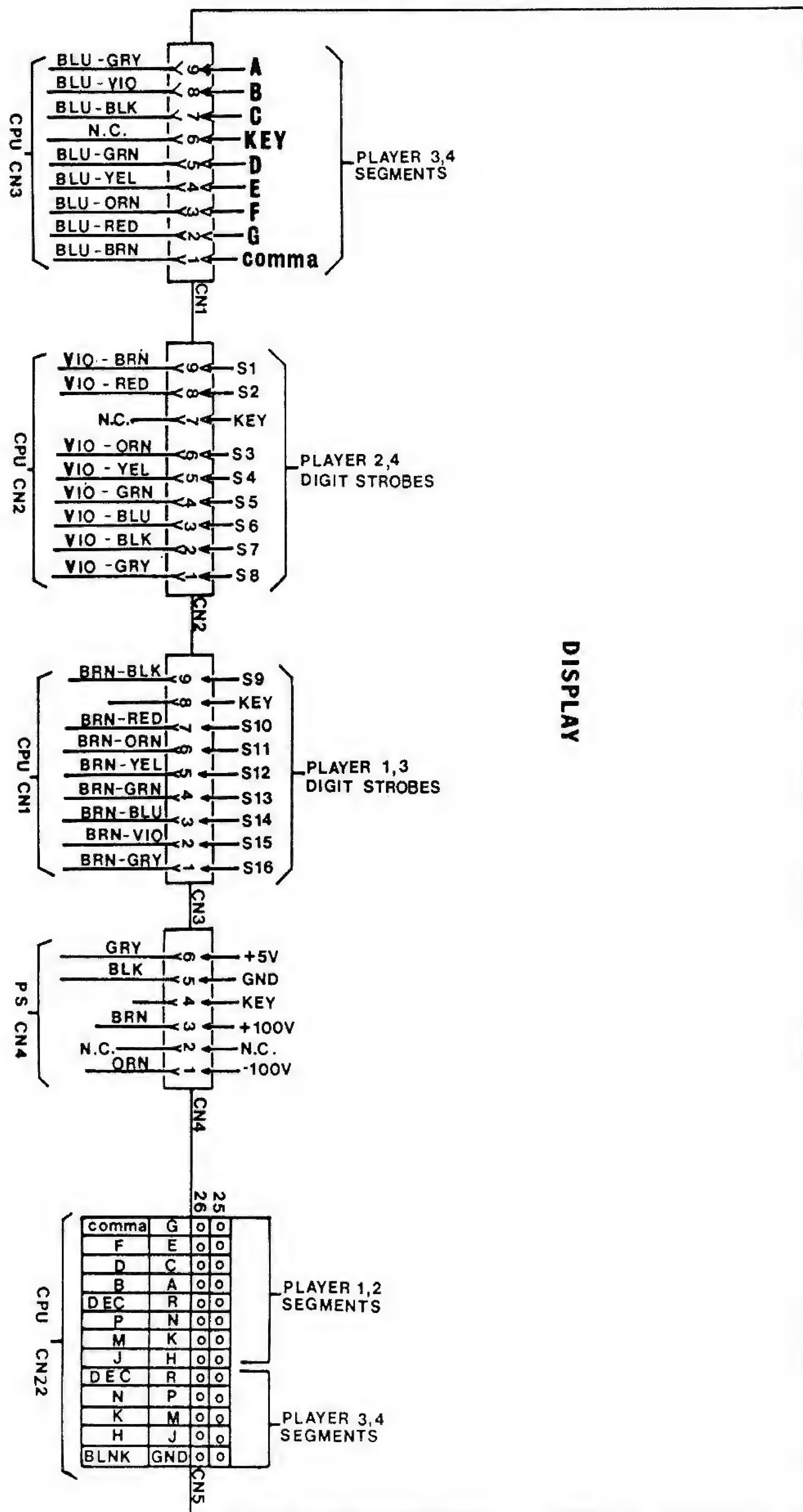
FOR LOWER LINE VOLTAGES
OR 230 VOLT OPERATION
SEE SAMPLES BELOW



230/218/206 VOLTS
IF1 = 4A SLO BLO
IV1 = 275V VARISTOR

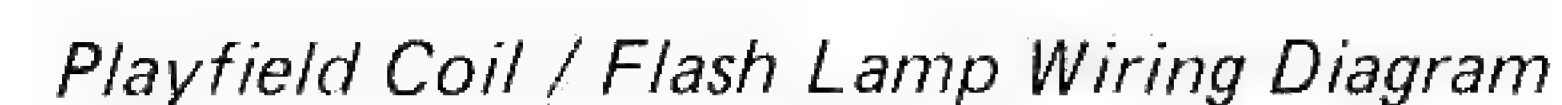


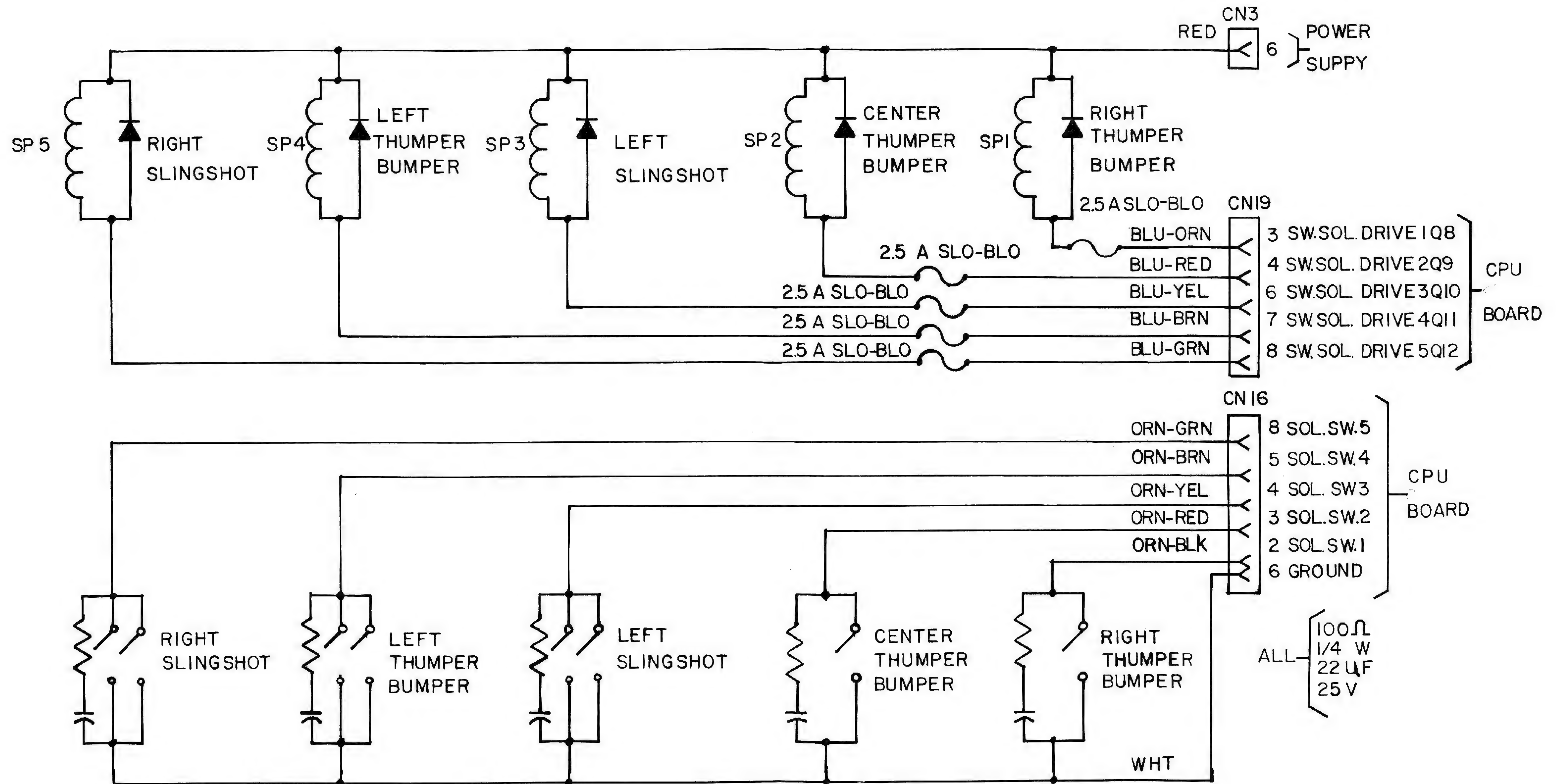




NOTES

Backbox Wiring Diagram

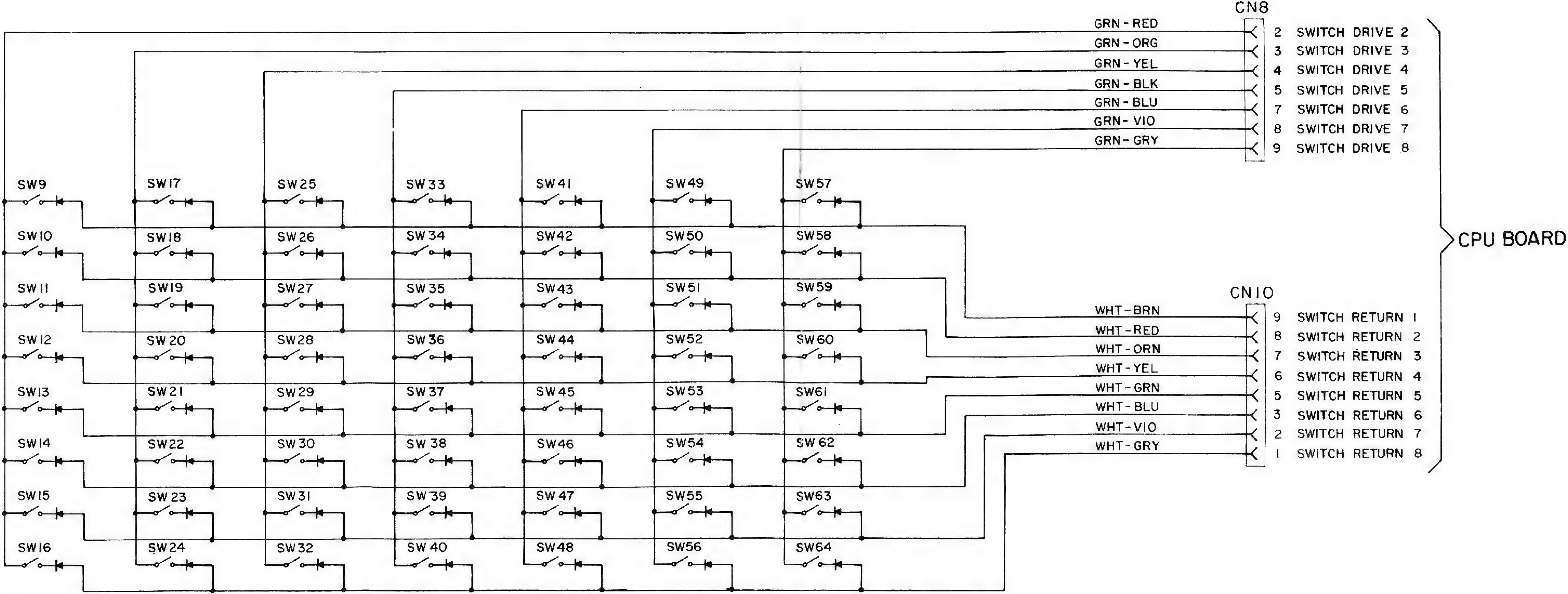




Switch
Number Description

01*	Plumb Tilt	16	Right Flip. Instant Info.	29	Left VUK #2	44	Right Super VUK	Switch Drive 1	Q55
02	Not Used		Right EOS	30	Left Ramp Top	45	Mirror Ramp	Switch Drive 2	Q54
03	Credit Button	17	Left Outlane	31	Left Ramp Bottom	46	Left Pop Bumper	Switch Drive 3	Q53
04*	Right Coin	18	Left Return Lane	32	Not Used	47	Center Pop Bumper	Switch Drive 4	Q52
05*	Center Coin	19	Right Outlane	33	Left Target 1 (Bottom)	48	Right Pop Bumper	Switch Drive 5	Q51
06*	Left Coin	20	Right Return Lane	34	Left Target 2 (Center)	49	Right Target 1 (Top)	Switch Drive 6	Q50
07*	Slam Tilt	21	Left Slingshot Trigger Sw.	35	Left Target 3 (Top)	50	Right 2 Target (Center)	Switch Drive 7	Q49
08	Not Used		Left Slingshot Point Sw.	36	Top Super VUK	51	Right 3 Target (Bottom)	Switch Drive 8	Q48
09	Not Used	22	Right Slingshot Trigger Sw.	37	Organ Cave	52	Organ Open		
10	Out Hole		Right Slingshot Point Sw.	38	Not Used	53	Organ Closed		
11	Trough #1	23	Right Spinner	39	Not Used	54	Not Used Through 64		
12	Trough #2	24	Not Used	40	Not Used				
13	Trough #3	25	Left Top Lane	41	Organ Target 1 (Left)				
14	Shooter Lane	26	Center Top Lane	42	Organ 2 Target (Center)				
15	Left Flip. Instant Info.	27	Right Top Lane	43	Organ 3 Target (Right)				
		28	Left VUK #1						

* Indicates cabinet switches.

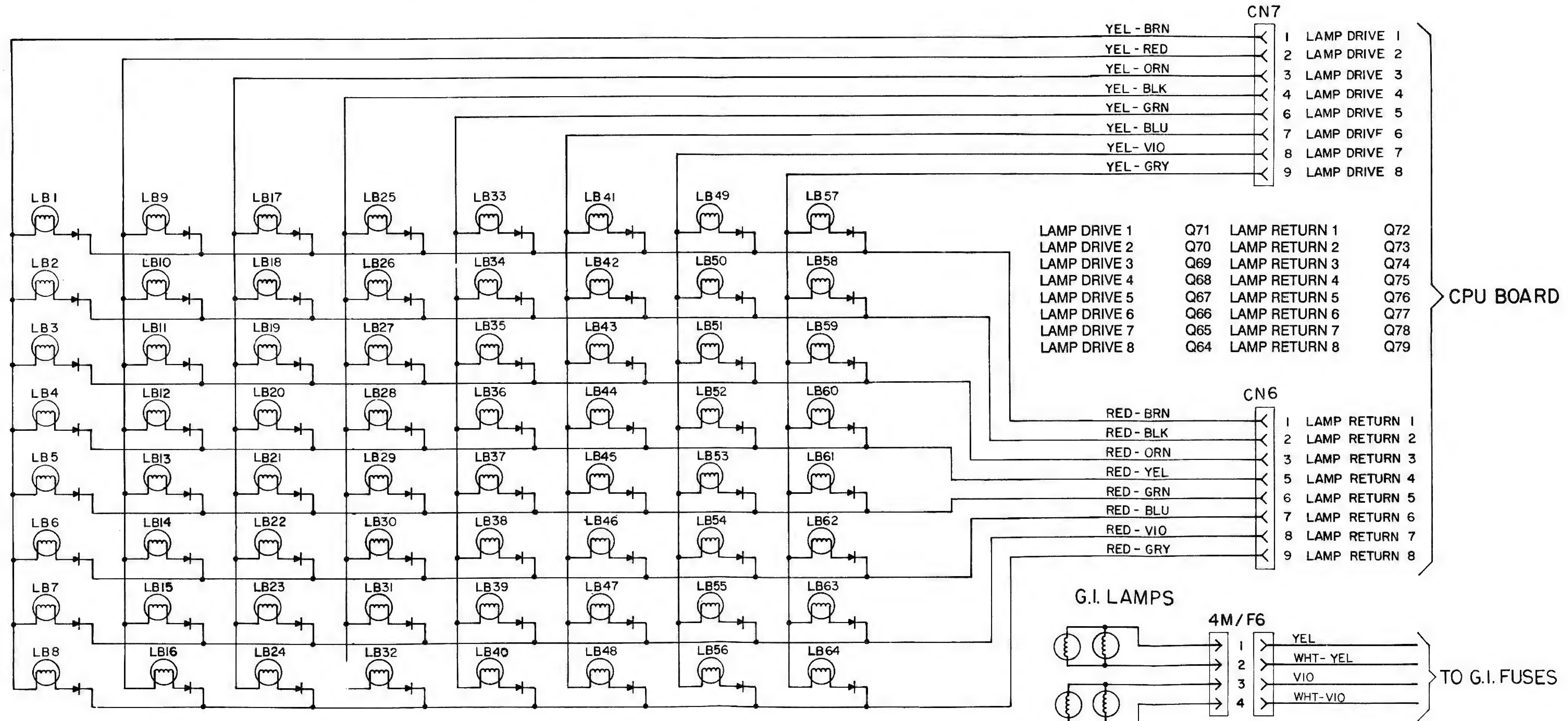


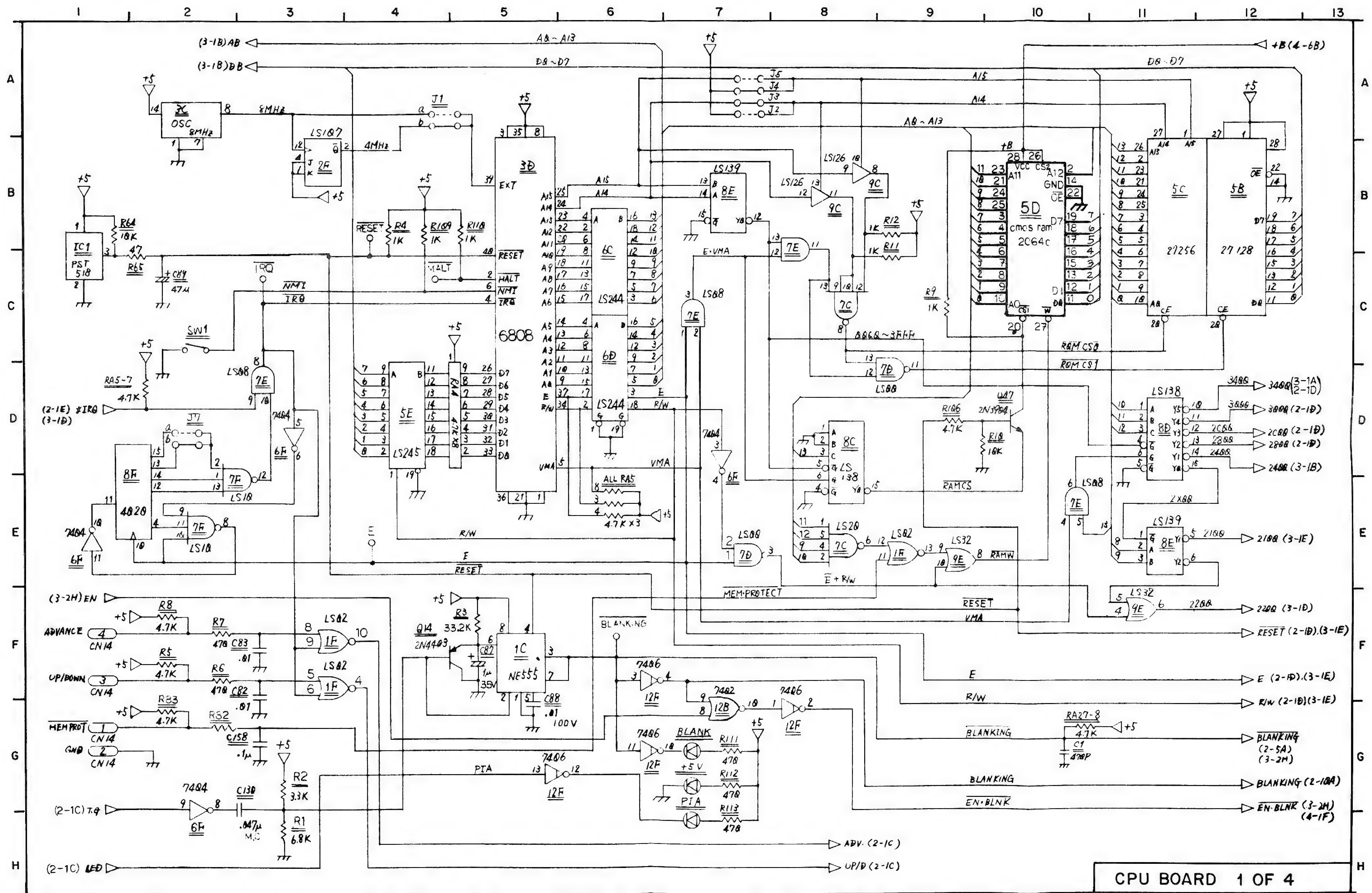
Lamp Number Description

01	Right Square 4	17	Left Square 4	33	Grasshopper 1 (Bottom)
02	Right Square 3	18	Left Candle	34	Grasshopper 2
03	Right Square 2	19	Phantom Lamp	35	Grasshopper 3 (Top)
04	Right Square 1	20	Left Square 3	36	2X Lit Lamp
05	Right Circle	21	Left Square 2	37	Left Mystery
06	Scorpion 3 (Bottom)	22	Left Square 1	38	Special Lamp
07	Scorpion 2 (Middle)	23	Bonus Hold Square	39*	Backglass 1
08	Lite Special	24	Shoot Again	40*	Backglass 2
09	Right Mystery	25	Left Circle	41	Top Lane 3 (Right)
10	Lock Arrow	26	5X Lamp	42	Top Lane 2
11	Lite Laser Kick	27	4X Lamp	43	Top Lane 1 (Left)
12	Right Candle	28	Bonus Hold Arrow	44	Left Return
13	Extra Ball Arrow	29	3X Lamp	45	Left Extra Ball
14	Scorpion 1 (Top)	30	2X Lamp	46	Laser Kick Lamp
15	100 K Square	31	Right Extra Ball	47*	Backglass 3
16	Lite Extra Ball	32	Right Return	48*	Backglass 4

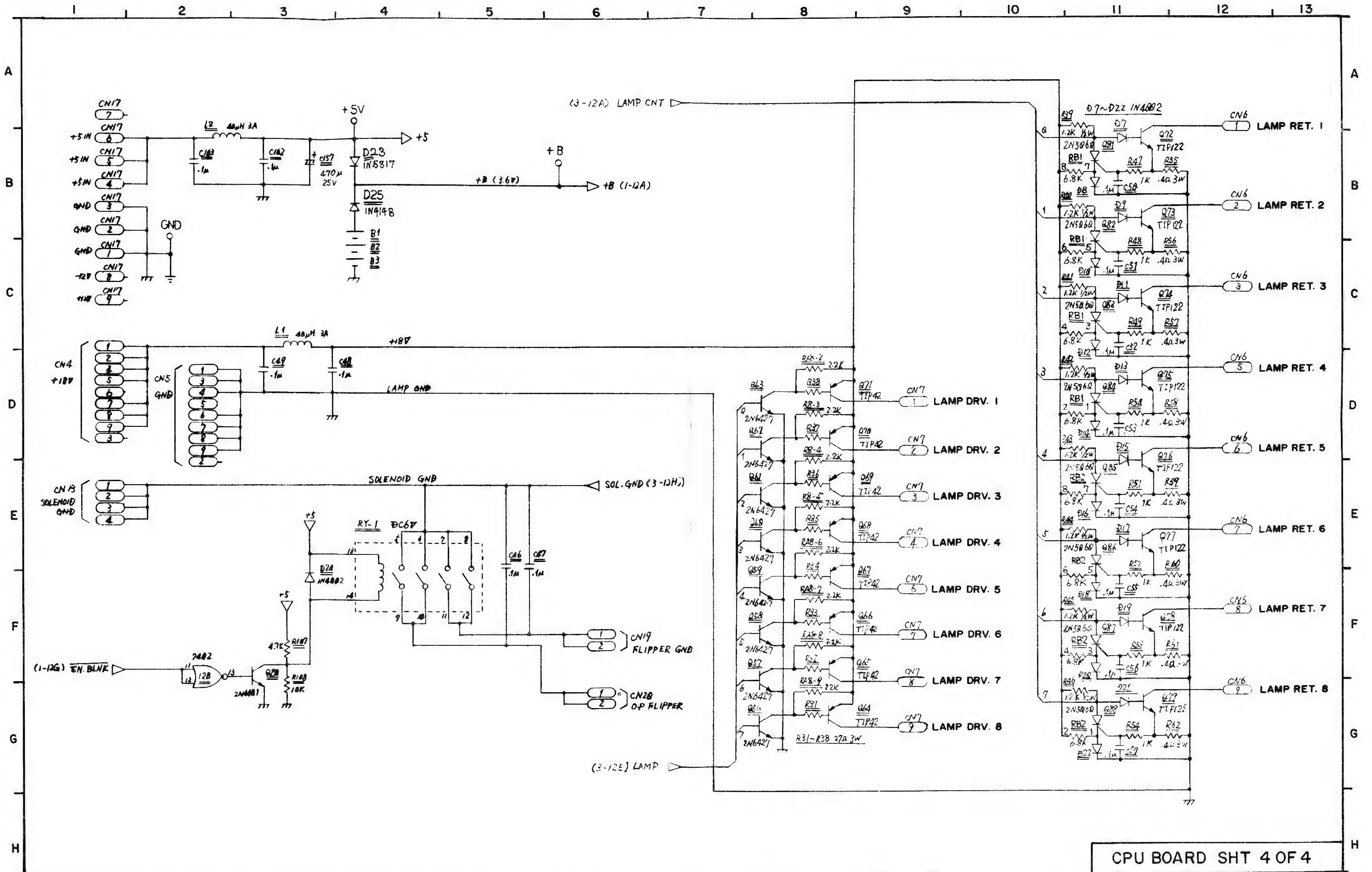
* Indicates insert board lamps.

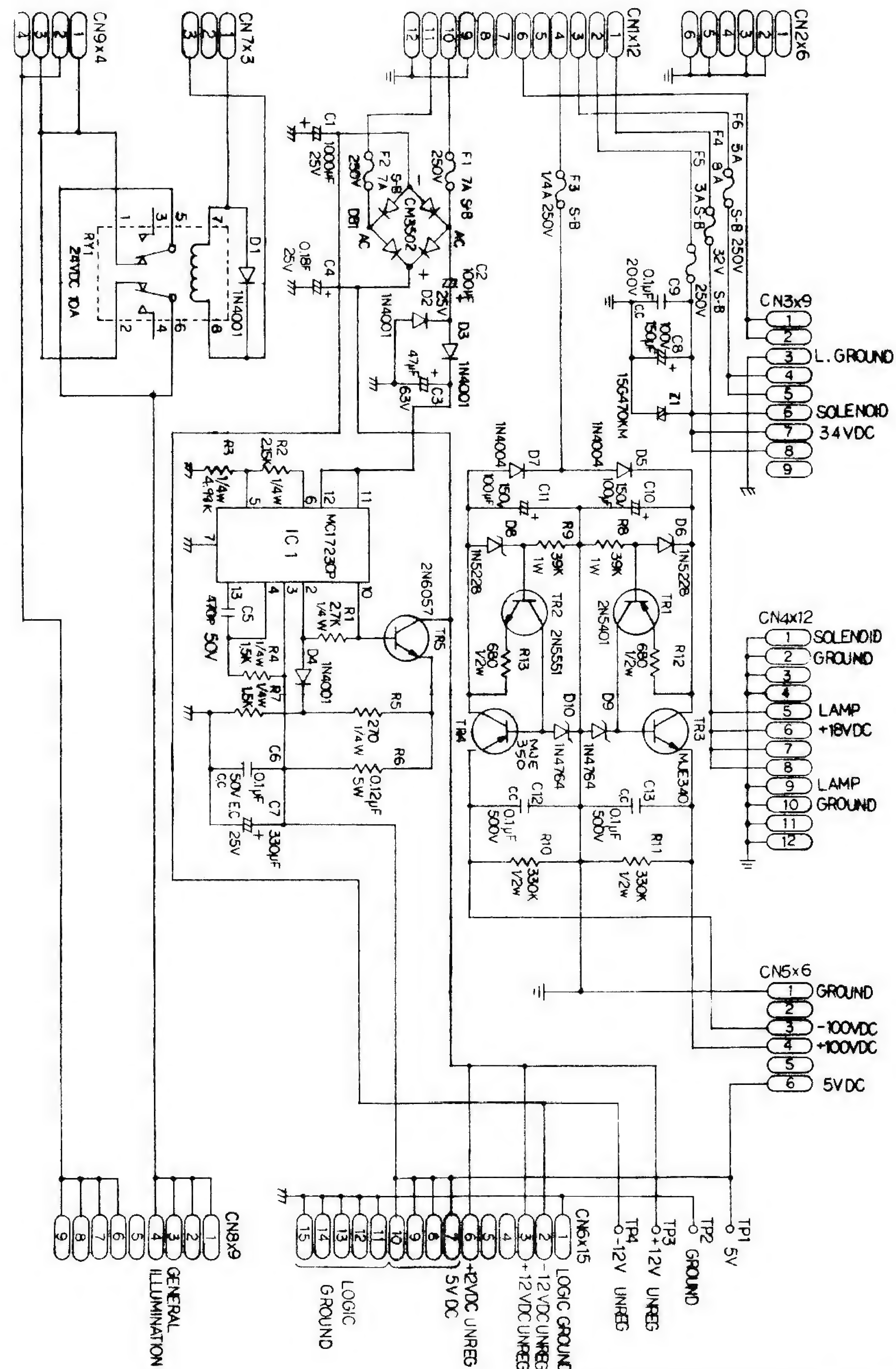
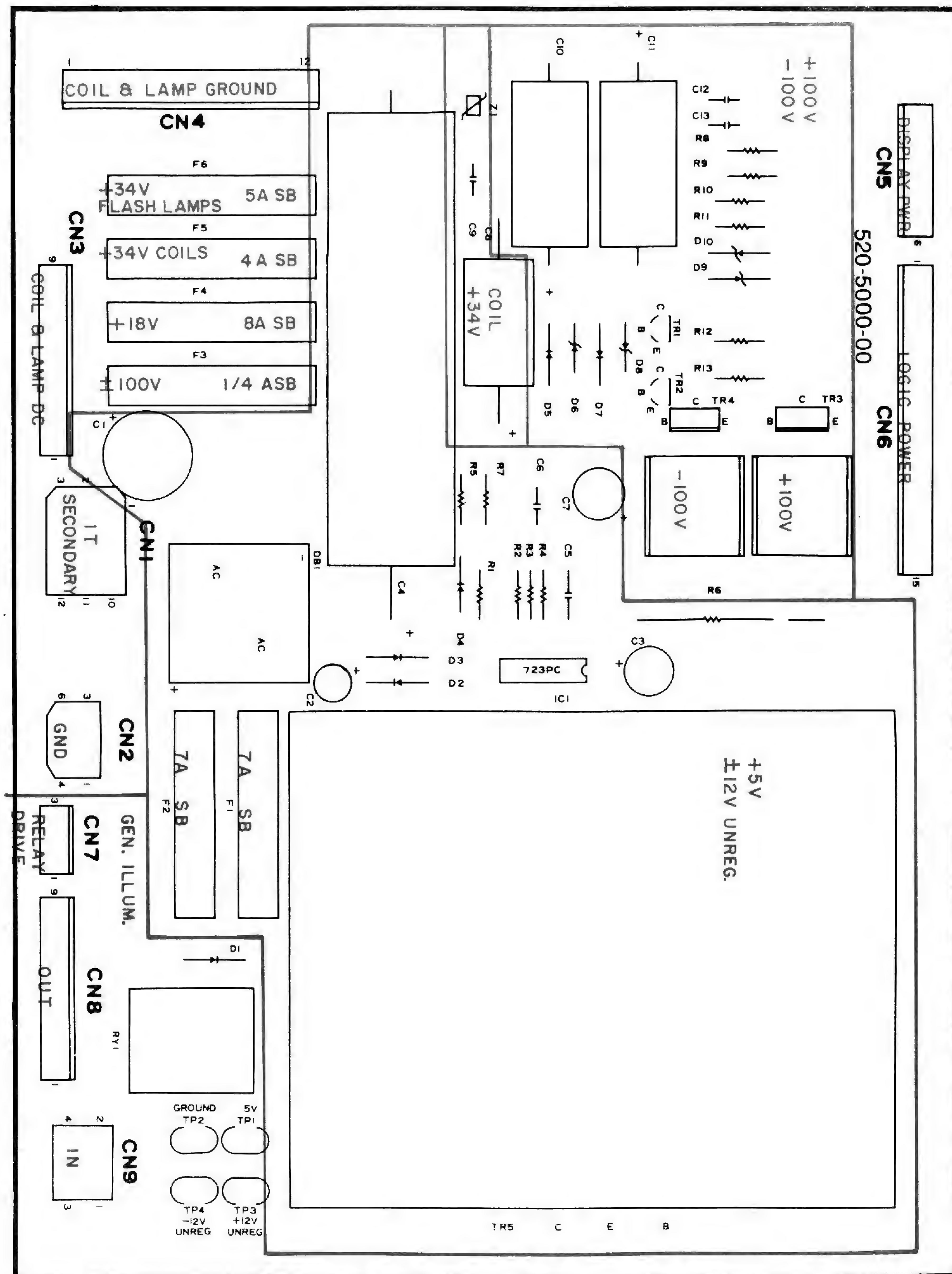
49	Phantom Lamp
50	pHantom Lamp
51	phAntom Lamp
52	phaNtom Lamp
53	phanTom Lamp
54	phantOm Lamp
55	phantoM Lamp
56	Unused
57	Box Lamp
58	Million Lamp
59	Two Arrow
60	tWo Arrow
61	twO Arrow
62	One Arrow
63	oNe Arrow
64	onE Arrow



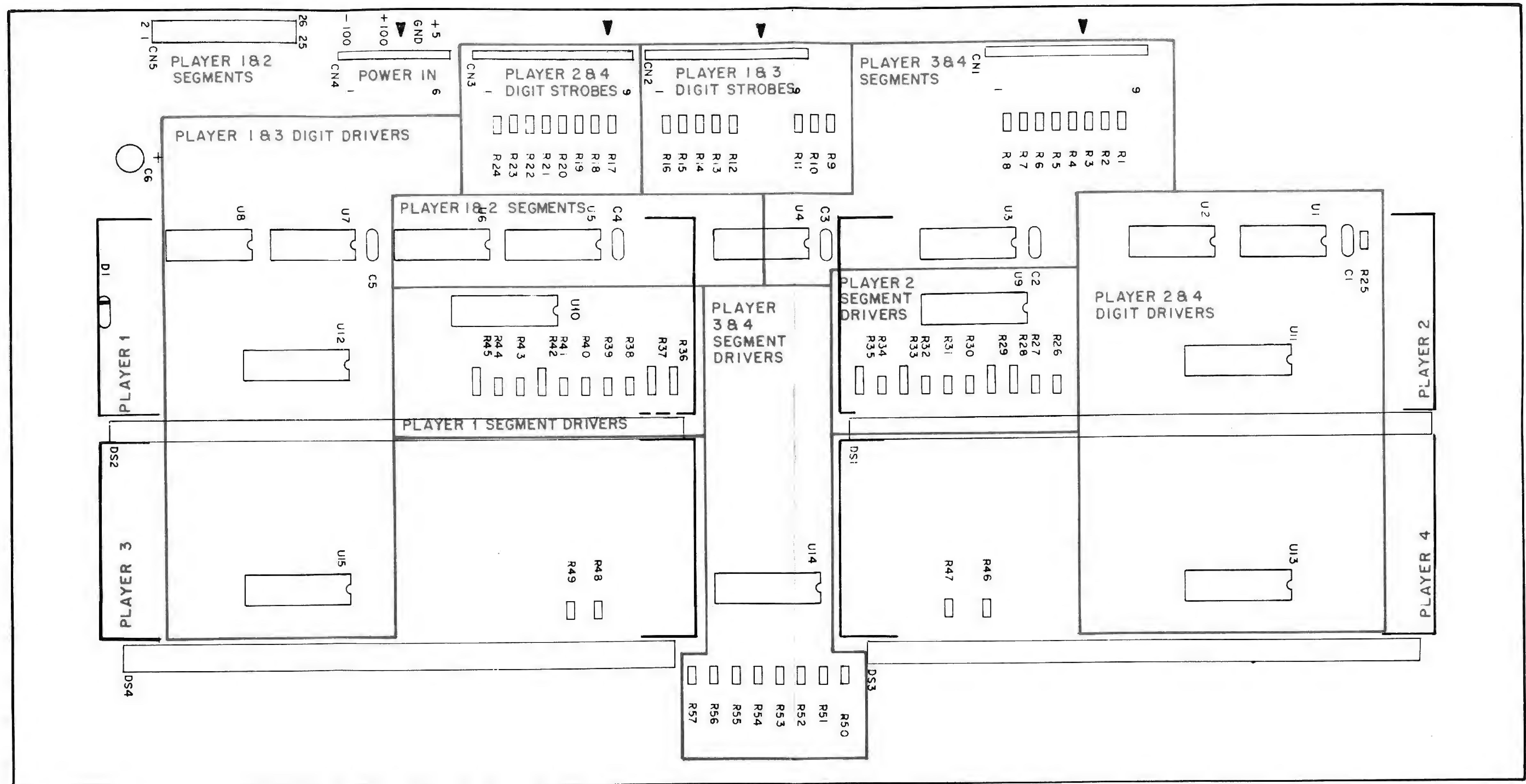


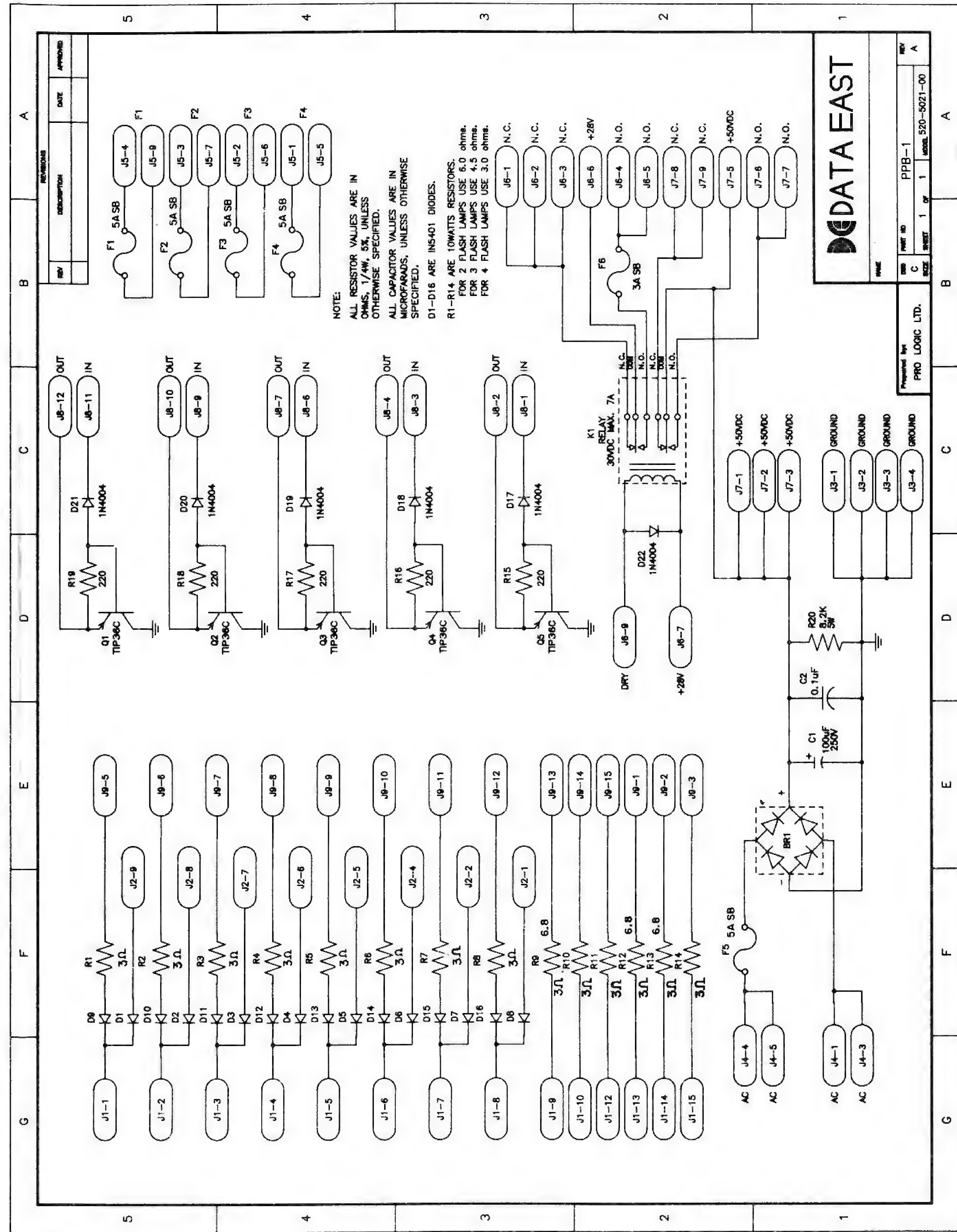
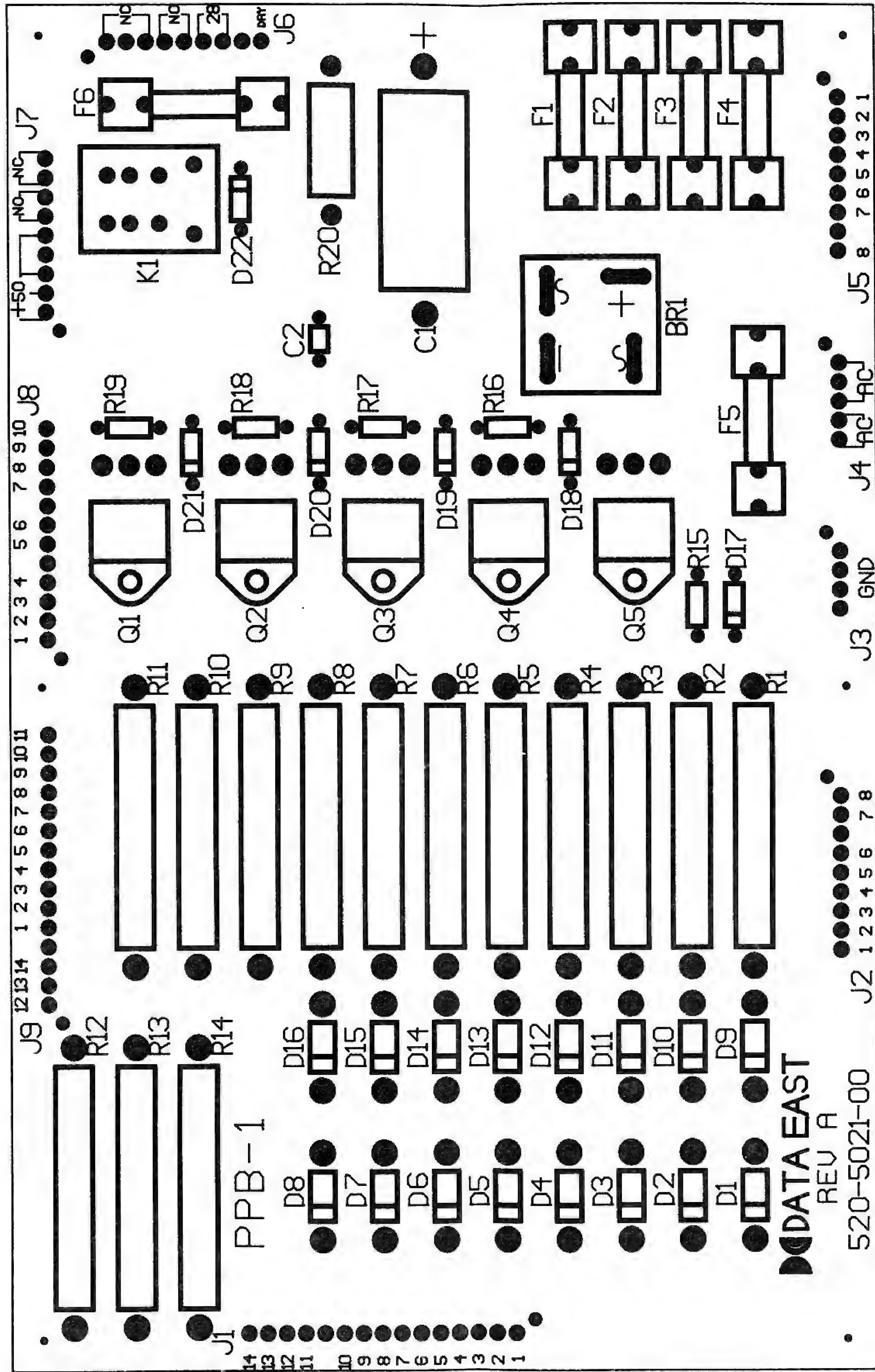


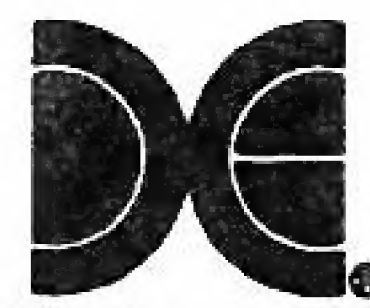












Theory of Operation for the Solid State Flippers

- The solid state flipper board is a dual flipper solenoid driver circuit. Each solenoid driver circuit contains a one shot timer, a 50V driver, and an 8V driver.

Looking at one circuit, Schmidt NAND gates U1A, U1B, and U1D make up the one shot timer. The timer length is controlled by R10, R33 and C2. The output of the timer is gated at U1C with the buffered switch input from Q6. The output of U1C controls the 50V driver circuit consisting of Q4, Q1, Q2, Q3, and D1. As long as the flipper button is activated, Q6 will keep the 8V driver circuit, SR1, on.

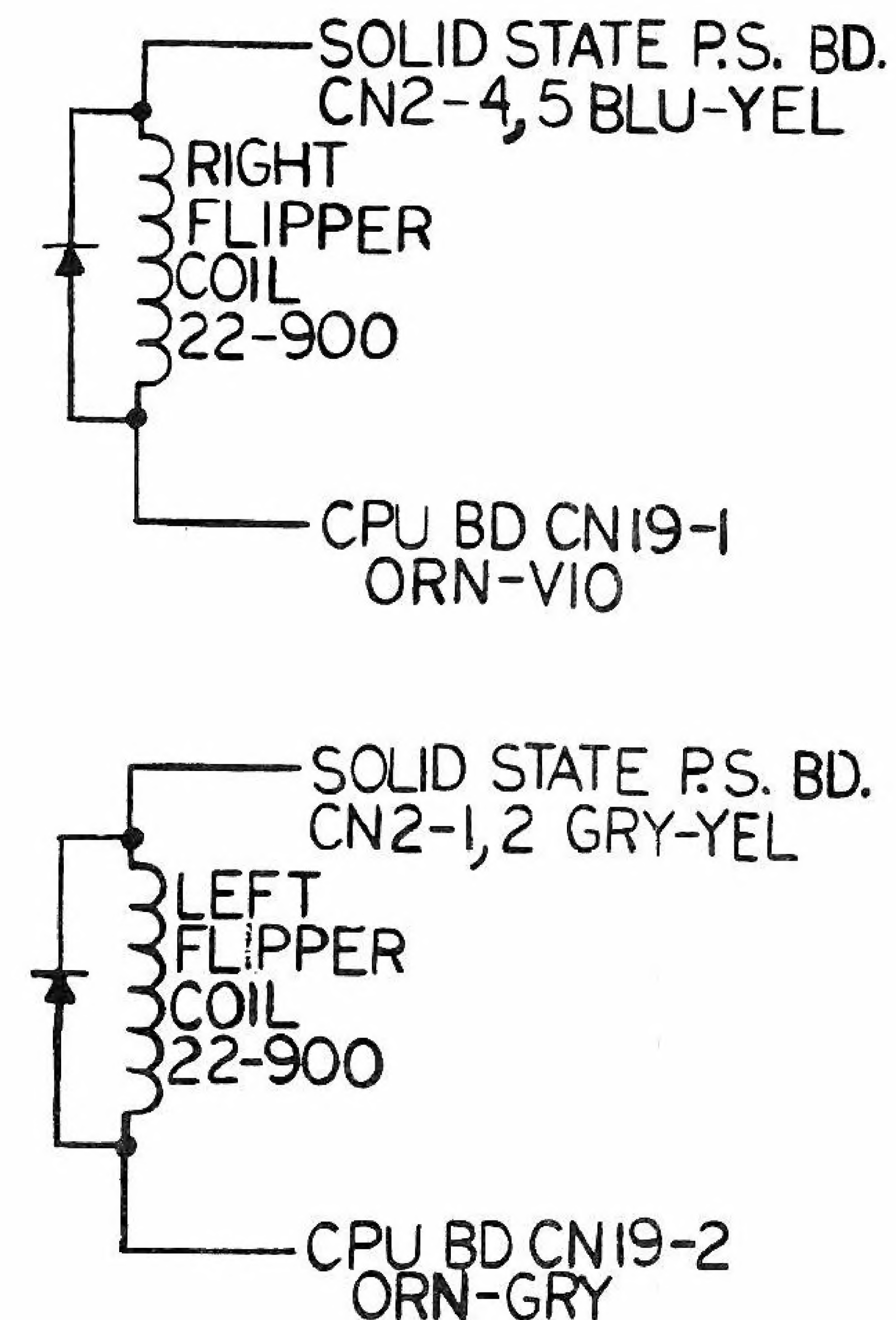
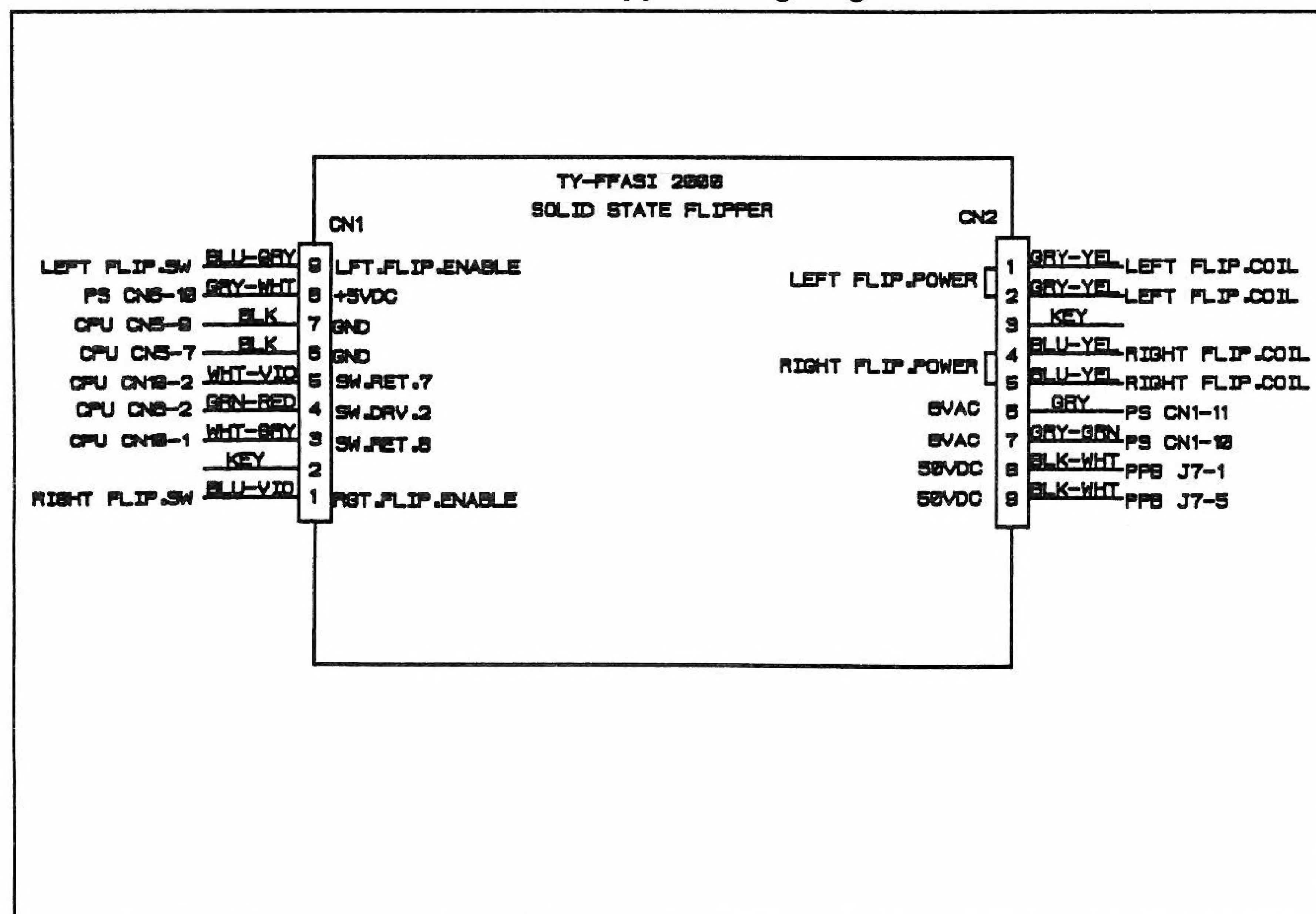
The 50V provides the actuation power to the flipper solenoid while the 8V provides the holding power.

Solid State Flippers PCB Wiring Diagram

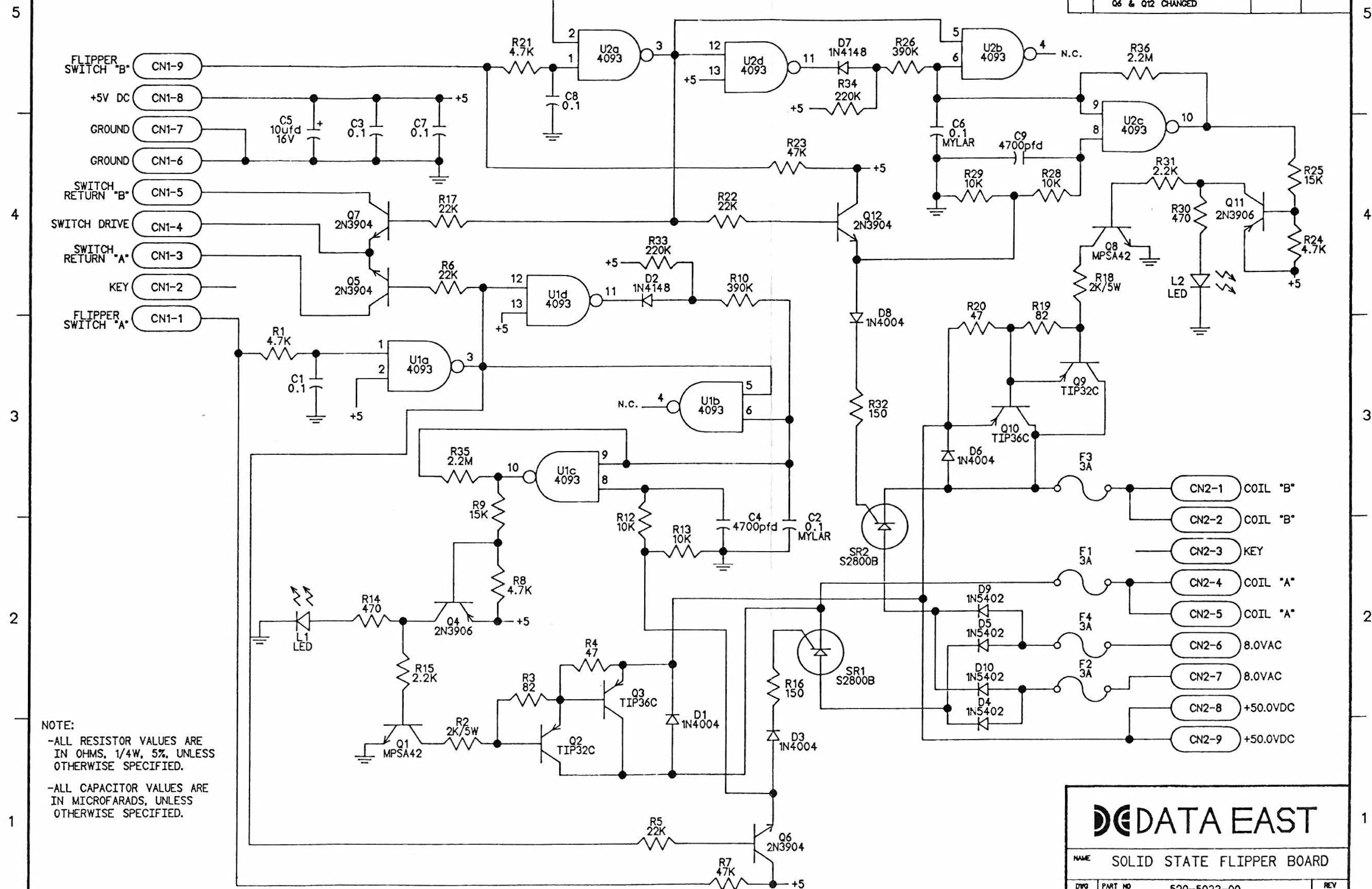
Connector CN 1			
Pin #	Goes To	Wire Color	It Is
1	Rgt. Flipper Sw.	BLU-VIO	RGT. FLIP ENABLE
2			KEY
3	CPU CN10-1	WHT-GRY	SW. RET 8
4	CPU CN8-2	GRN-RED	SW. DRV 2
5	CPU CN10-2	WHT-VIO	SW. RET 7
6	CPU CN5-7	BLK	GND
7	CPU CN5-9	BLK	GND
8	PS CN6-10	GRY-WHT	+5VDC
9	Lft. Flipper Sw.	BLU-GRY	LFT. FLIP ENABLE

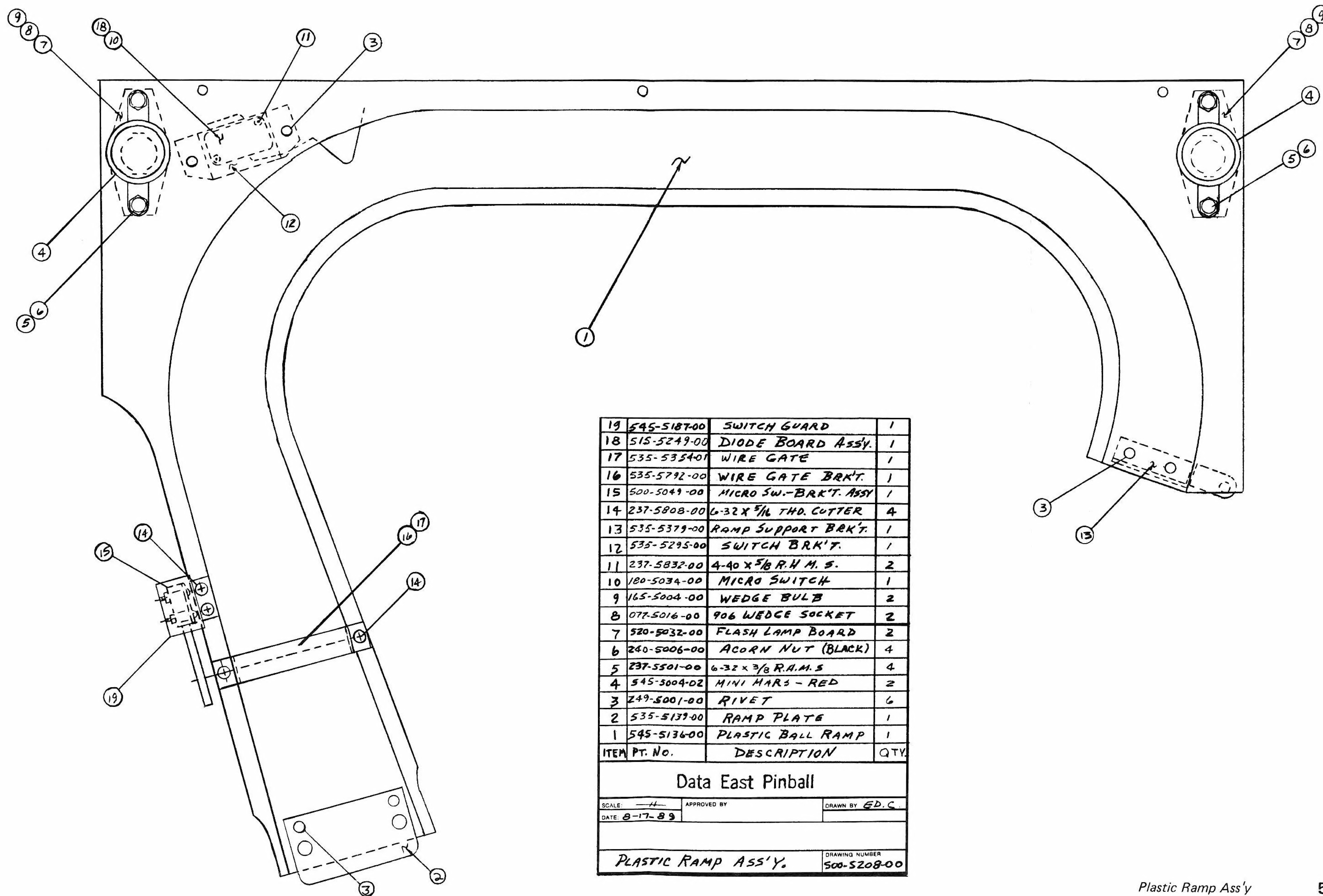
Connector CN 2			
Pin #	Goes To	Wire Color	It Is
1	Lft. Flip Coil	GRY-YEL	LFT. FLIP POWER
2
3			KEY
4	Rgt. Flip Coil	BLU-YEL	RGT. FLIP POWER
5
6	PS CN1-11	GRY	9 VAC
7	PS CN1-10	GRY-GRN	9 VAC
8	PPB J7-1	BLK-WHT	50 VDC
9	PPB J7-5	BLK-WHT	50 VDC

Solid State Flipper Wiring Diagram



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
C	R10 AND R26 VALUES CHANGED.	11-30-89	
E	C10 AND C11 DELETED RESISTOR VALUES CHANGED Q6 & Q12 CHANGED	3-13-90	





19	545-5187-00	SWITCH GUARD	1
18	515-5249-00	DIODE BOARD ASSY.	1
17	535-5354-01	WIRE GATE	1
16	535-5792-00	WIRE GATE BRKT.	1
15	500-5049-00	MICRO SW.-BRKT. ASSY	1
14	237-5808-00	6-32 X 5/16 THD. CUTTER	4
13	535-5379-00	RAMP SUPPORT BRKT.	1
12	535-5295-00	SWITCH BRKT.	1
11	237-5832-00	4-40 X 5/8 R.H.M.S.	2
10	180-5034-00	MICRO SWITCH	1
9	165-5004-00	WEDGE BULB	2
8	077-5016-00	906 WEDGE SOCKET	2
7	520-5032-00	FLASH LAMP BOARD	2
6	240-5006-00	ACORN NUT (BLACK)	4
5	237-5501-00	6-32 X 3/8 R.A.M.S	4
4	545-3004-02	MINI NUTS - RED	2
3	249-5001-00	RIVET	6
2	535-5139-00	RAMP PLATE	1
1	545-5136-00	PLASTIC BALL RAMP	1
ITEM	PT. NO.	DESCRIPTION	QTY.
Data East Pinball			
SCALE: <u>1/4"</u>		APPROVED BY	DRAWN BY <u>ED.C.</u>
DATE: <u>8-17-89</u>			
PLASTIC RAMP ASS'Y.		DRAWING NUMBER 500-5208-00	

237-5501-00 (2EA)
#6-32 3/8 M.S.
240-5004-00 (2EA)
#6 HEX NUT

249-5001-00
RIVET 1/8 x 5/32
(2 -RLQ'D)

237-5808-00 (4)

535-5800-02

(A) 535-5795-00
626-5005-00

535-5800-01

535-5731-00
HANGER BRKT. (2EA)

545-5144-00
BALL RAMP (REAR UNDER)

500-5159-00
MICRO SW. & BRKT ASS'Y

(A)	FOAM TAPE AND PLATE ADDED	E.C.	1-15-90
REV	DESCRIPTION	BY	DATE
DATA EAST PINBALL INC.			
SCALE: 1" = 1"	APPROVED BY		DRAWN BY D. GOULD
DATE: 1-3-89			PHANTOM
BALL RAMP ASS'Y (REAR UNDER)			DRAWING NUMBER 500-5161-00